Motorola
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Communications and Electronics Division.

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Special MSS Edition

In this issue . . .

Gulf Refining Company controls marine producing lease via radio

(Cover story Page 14)

OPERATIONAL RESEARCH

Cybernetics, automation, and operational research are terms which have been tossed about in scientific and engineering journals of late. Publicity afforded such automatic manufacturing systems as that publicized by Project Tinkertoy has stimulated further interest in the terms. Recently, Mr. William L. Swager, of Battelle Institute, suggested to me that an operational research study of the radio applications to state police or city police communications systems might be rewarding. We enjoyed an interesting discussion, and I think we agreed that such a study could provide information to guide the orderly growth of a police system into a more closely integrated, partially automatic, more efficient operation.

There is little doubt in the mind of any engineer who has studied modern equipment for storing and processing information, for selecting, and for providing automatic control and disciplining feedback, that the utilization of the modern art of control could add to the effectiveness of any police radio system. The unknown question is not the question of potential improvement, but rather, whether or not the improvement could be justified despite the increased cost. An operational research study costs money, also.

While the term "operational research" is comparatively new, the procedure described is not new. Operational research is essentially the application of scientific method to systems study. When you make a clear statement of your objectives and then study the influence of all factors and analyze the methods for achieving the objectives in a systems operation, you are performing an operational research study.

The application of electronic devices to the extension of man's mental powers in systems control is a form of applied cybernetics. Automation refers primarily to the performance of mechanical functions with automatic control.

All of these fancy terms are very interesting and they do serve to give new emphasis to ideas which are establishing trends in industry. The impressive terms should not confuse us into thinking that they carry any inherent magic in embodiments which will cure all ills and solve all problems. Cybernetics, automation, operational research, are important only to the degree that they contribute to improve efficiency or to a reduction in operational costs. I am convinced, however, that a very substantial potential for such improvements exists in industrial systems operation and in safety service communication systems.

Why not initiate an operational research program for your communication system? Abandon, for the time being, any cut-and-dry changes and piecemeal adjustments and view the entire police operation as a system. Define your objectives and study all the radio factors which influence the efficient performance of your duties. In the course of the study, you would examine the influence of automatic push-button dispatching, of selective calling, of punch card, punch tape, magnetic tape or magnetic drum, programming, of automatic coded reporting, of duplex operation, of automatic mobile identification, and of many other approaches which may help to organize, integrate and discipline the use of radio communication into a more sharply effective tool. The development of an adequate operational research study would provide a plan for growth which would have reason and order, and which would look toward the maturing of systems utilization. Hodge-podge and patchwork would yield to a reasoned pattern for the accumulation of improvements. Yearly re-evaluations would keep the plan up to date and insure growth in step with the advance of the art.

There is much to be said for the operational research approach. The evaluation of the cost factors becomes an important part of the study, and all recommendations for growth result from an examination of all of the factors, rather than from a look at one operation without adequate concern for the influence upon other parts of the system. A plan for the future is essential to orderly growth of any system.

Do you have a plan for the use of selective calling in your system? It is inevitable that all mobile equipment will be equipped with selective calling equipment. The rise of spectrum congestion produces more and more nuisance interference, which can never be controlled by selectivity or filter design. We have defined nuisance interference as weak signals strong enough to open squelch and produce audio signals, but weak enough to be overridden by the desired signal when the base station transmitter is on the air. Nuisance interference does not disrupt primary communications, but it produces fatigue and noise, and sometimes confusion, by disturbing an otherwise quiet stand-by condition. Selective calling will keep the speaker muted until the desired station transmits a message. Individual calls, group calls, and general calls, provide versatility to meet a variety of operational requirements. The selective calling system must be simple and reliable.

The Motorola Quik-Call system is simple, reliable and versatile. I examined personally all of the possible approaches, including step switches, relay counters, twin-T selective networks, and several other forms; but the electro-mechanical filter system was the only one which satisfied my requirements for simplicity, permanent adjustment and a minimum of parts. The availability of the modern iso-elastic materials made it possible to build a mechanical resonant device which maintains a remarkable stability over a wide range of temperature. The use of this material in the development of the Motorola Vibrasponder and Vibrasender provided a fixed signal source and a permanently tuned, resonant responsive device which made it unnecessary to coordinate or adjust frequencies in the field. We have added refinements over a period of seven or eight years, and Quik-Call is a mature device. We think that the Motorola Vibrasender-Vibrasponder Quik-Call system has a place in your future.

Dan Noble

From_____

Street_____

City_____ State_____

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FOLD, SEAL AND MAIL

The

Motorola Newsgram

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RADIOS TO BE ATOM-TESTED

The toughest test ever devised for radio equipment—exposure to a nuclear explosion—is being planned by the Federal Civil Defense Administration and industry. Testing will be held in April at the Nevada Test Site at Mercury, Nevada, 65 miles northwest of Las Vegas.

A typical industry participant is the Communications & Electronics Division of Motorola, Inc.

From the blast tests Motorola engineers expect to learn how well the nation's vital mobile 2-way radio systems could withstand an enemy atomic attack.

Motorola and other member companies of the Radio-Electronics-Television Manufacturers Association are taking part in the Civil Defense portion of the atomic test series under FCDA auspices to obtain technical information needed for Civil Defense planning and in the interest of national defense.

Typical commercial transmitters, receivers and antennas in operating condition will be exposed to the nuclear explosion at varying distances from Ground Zero. Motorola will test its portable, mobile and fixed station radio equipment models which are widely used by police and fire departments, taxicabs, railroads, power utilities and mobile telephones in the 152-174 megacycle frequencies, as these services' communications are considered extremely important to Civil Defense in case of disaster or enemy attack.

From Motorola's standpoint the nuclear tests will be a logical extension of rigorous field testing which is carried on 24 hours a day under actual user conditions.

Equipment to be tested includes Motorola FM base stations with 30-watt transmitters and Sensicon receivers housed in standard desk-top console cabinets; battery-powered "Handie-Talkie" portable radio-phones; 30-watt FM mobile transmitter-receivers, trunk mounted in automobiles especially purchased for the tests; and several types of fixed station antennas.

Lloyd P. Morris, chief engineer of Motorola's National Radio Systems Consulting Service, is the company's engineering representative to the RETMA atomic test planning committee.

Supervising the blast tests for the company as project consultant will be Carl Tinsley, development engineer at the Motorola Research Laboratory in Phoenix, Arizona. Tinsley, an electrical engineering graduate of the University of Missouri, is particularly well suited for the atomic explosion assignment, having spent several years at the Signal Corps Engineering Laboratories at Fort Monmouth, New Jersey, before joining Motorola early in 1954.

Tinsley and FCDA engineers will check the radio communications equipment thoroughly for physical damage and system performance, in addition to tests of receiver sensitivity, transmitter output and other pertinent electrical characteristics before and after the blasts.

Office Manager B. F. Newman keeps radio microphone handy.

Instantaneous Communication, plus Dispersed Storage, Lets Four Trucks Do the Work of Five for Texas LP Firm

RADIO BUILDS PROFITS FOR BUTANE DEALERS

An East Texas butane-propane dealer has found the secret of making four trucks do the work of five.

The success story of Morris Sneed's Butane Service Company is simple—and it can mean the difference between loss and profit for small LP gas operators all over the country.

Sneed has spread his liquefied petroleum storage tanks to the four corners of his five-county service area. More important, he has put two-way radios in Butane Service's four delivery trucks. Net result is that each truck now handles at least 25 per cent more business than it did under the old system.

Butane Service Company sells LP gas products to rural customers in a 50-mile radius around Fairfield, Texas. As the business grew, Sneed and Office Manager Billie Newman faced the decision of whether to add a fifth truck at a cost of about $5,000, or put in radio equipment at somewhat less cost to boost the existing four trucks' productivity to handle extra business.

They went to radio. That decision has been coining extra profits every month since Butane Service went on the air.

Newman admits he's amazed. He thought the only advantage would be in cutting down on "runback" miles—the lost time and travel of delivery trucks returning to supply customers who telephone in for LP service.

They save the runback, all right—but they've discovered other uses almost as valuable.

Sneed uses the radio to direct his route men to new call-in customers. He also radios instructions on whether to refill the trucks with propane or butane at the remote storage points.

The drivers prize their radios —particularly the man whose truck bogged down on a muddy country lane late one cold January afternoon. The nearest farm house with a telephone was six miles away. The driver's distress call was heard by Sneed (whose personal car carries a two-way radio set) and a wrecker was on the way before the truck engine had cooled off.

"We saved that driver a long, cold walk and gained an extra half day of service from the truck," Sneed says.

The radio takes some explaining, however. One woman customer drove to a cross-road store to order butane by telephone, then couldn't believe her eyes when she returned home to find one of Sneed's trucks already filling her tank. The driver explained that he was passing her farm when the order reached him

by radio. Making deliveries within two or three minutes after the order is no longer unusual for Butane Service drivers.

During a normal winter's day, Sneed's trucks will deliver several times their 1,100-gallon capacity. When all storage was concentrated in Fairfield, trucks had to be brought up to 40 miles off their routes for refilling.

Sneed whipped this problem by decentralizing his storage. In addition to a 17,000-gallon stock at Fairfield, he installed 12,000-gallon tanks at Marquez, 40 miles to the south, and at Groesbeck, 30 miles west. Seventeen miles east of Fairfield, Butane Service Company stores its LP supply in two underground wells having a capacity of 2,000,000 gallons.

The wells, shared with two other LP gas distributors, are Sneed's hidden assets. Drilled hundreds of feet into a salt dome formation, the wells were enlarged far underground by pumping in water which dissolved the salt. The capacity can be increased to 10,000,000 gallons at small additional cost.

At the well site, steel tanks of 36,000-gallon capacity refill trucks delivering on routes east of Fairfield.

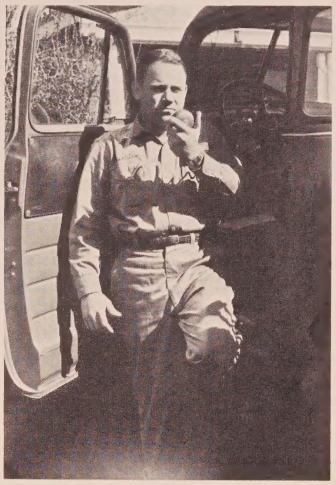
The huge underground storage facilities can be filled during summer months when demand is slack, then emptied during peak consumption winter months. In addition, Sneed's transport trucks shuttle year-round to his supply sources in the East Texas oil fields.

Sneed shares his radio channel with other LP distributors in Central and East Texas. His base station antenna rises above a 140-foot municipal water tank, with the 60-watt Motorola transmitter and receiver enclosed in a locked weatherproof cabinet at the foot of the tower. Telephone lines tie the station to identical remote control consolettes at the office and at Sneed's home two blocks away.

Each truck is equipped with a 60-watt Motorola transmitter and receiver. Operating frequencies are arranged to allow direct truck to truck communication without going through the base station if the need arises.

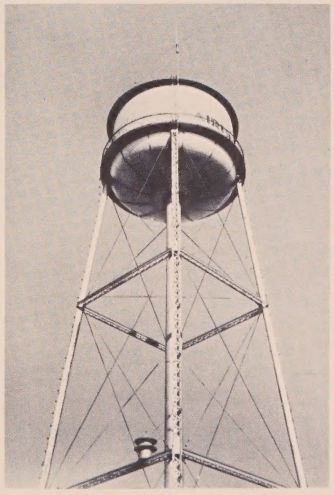
A sturdy weathertight box atop the truck's tanks holds the mobile radio out of the way, yet makes the equipment easy to service. A loudspeaker on the engine firewall puts Sneed's or Newman's voice in the truck with the driver, and a military-type microphone hangs on the instrument panel in easy reach of the operator.

Morris Sneed believes that radio-dispatching may become a "must" for the other small distributors as competition for LP gas business becomes greater. His fleet of four trucks is proof that there's no such thing as a business too small to use radio profitably.

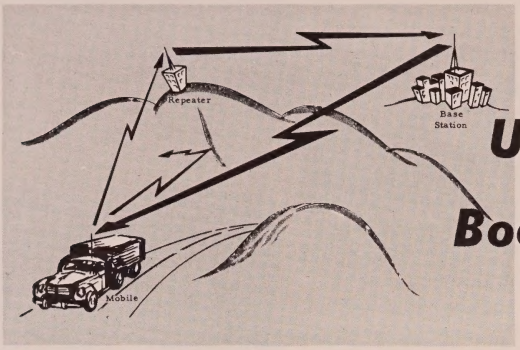


Driver Dwayne Chappell checks in for his next stop when a customer tank is filled.

Mobile radio unit rides atop twin tanks, out of driver's way yet easily accessible for frequency checks required by FCC.



Butane Service Company's radio antenna is mounted on top of city's 140-foot water tower.



Unattended Repeater Boosts Radio Coverage

Borrowed radio technique pays off for truckers

Southern California truckers are borrowing a technique long used by the commercial radio and TV broadcasters—if you want wide coverage, find a mountain top for your radio antenna.

First motor carrier to try the hill-top idea in Los Angeles was Wells Truckways Limited, which went on the air last August with a private radio system linking 20 cars and trucks to their terminal at 1045 So. Greenwood, Montebello, just outside of Los Angeles.

To achieve the necessary coverage, Wells "found a mountain" in Glendale—the 2,000-foot Flint Peak, situated about 12 miles distant from the carrier's terminal. Using a fully automatic, unattended repeater station on Flint Peak, Wells' base station in Montebello enjoys two-way communication with vehicles practically anywhere within a 30-mile range. Coverage extends westward over a considerable part of the San Fernando Valley and south to Long Beach, where the company handles heavy traffic in cotton.

The idea of remotely controlling a radio transmitter from a distant microphone is not new. For years commercial broadcast stations have maintained studios downtown and piped programs over leased wires to transmitters located on the outskirts of town. Wells' system is worthy of mention because no expensive wire lines are needed—messages from the city dispatcher go out to the truck in two hops—from a 20-watt transmitter at the terminal to the Flint Peak repeater, where the information is automatically rebroadcast to all the Greater Los Angeles area. Truck drivers answer the same way—from the mobile transmitters in their trucks, messages go to the Flint Peak repeater station and are rebroadcast to the terminal. Messages go by radio all the way.

Officials of the company estimate the monthly saving in line costs at $75 or more.

Wells Truckways has found their 460-mc. frequency ideal for its communications. In contrast to lower frequencies which are sometimes affected by "skip" interference from distant stations, the ultra-high-frequency Citizens Band is relatively free from interference. Also the short waves give exceptionally good coverage to trucks in the downtown Los Angeles area, literally bouncing off the tall buildings to insure solid signals anywhere.

Biggest booster for the new radio system is Mr. Othal P. Wells, president of the company. Wells has a two-way mobile radio unit in his auto and uses it frequently to contact his office and the trucks. He is already planning to double the number of Motorola radio-equipped trucks in 1955—a good indication of the value he places on the radio system.

In addition to the usual city dispatching of pickup and delivery vehicles, the Wells firm finds its private radio network valuable for contacting its Long Beach personnel. The company does not maintain an office in the Long Beach dock area, but operates from its foreman's "office" in his pickup truck. Prior to radio it was virtually impossible to reach the foreman by telephone, and much time was lost in needless driving between Los Angeles and Long Beach. Now with two-way radio in the foreman's truck, he is instantly available for conferences and instructions.

Radio was planned as an integral part of Wells Truckways' new million-dollar terminal which was opened in August, 1954. The dispatching office is arranged so that two men share control of the radio. A telephone-type handset hangs beside each man, and either can transmit at will. Lifting the handset silences the radio loud-

speaker and the dispatcher carries on his radio transmission over the hand microphone and earphone, leaving the other dispatcher undisturbed.

The mobile radio units are ingeniously installed in the truck cabs, bolted to the wall behind the driver's seat. On the instrument panel within easy reach of the driver is the military-type microphone, simple controls to set the receiver volume and noise limiter, and the loudspeaker. By means of the Flint Peak repeater station, every driver hears both sides of all message transmissions, and any truck or supervisor's car can talk directly to any other radio-equipped Wells vehicle in the coverage area.

As for savings resulting from use of radio, Terminal Manager Charles Tigar says flatly that the new all-Motorola communications system "saved us countless hours and a lot of money from the first day we put it in."

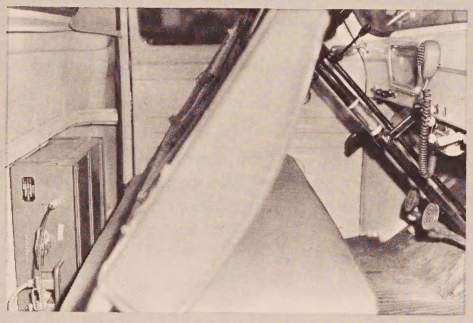
For example, trucks assigned to the dock area were virtually lost from the time they left the Montebello terminal, and this frequently caused long, profitless trips back and forth. A load of freight might be ready to go 5 minutes after a Wells truck passed a shipper's dock, but without communication the driver had no way of knowing. Now, says Tigar, those loads are handled without runback time.

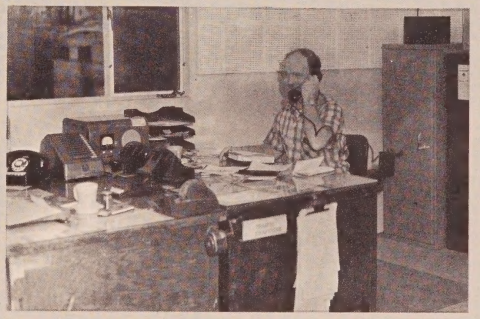
Trucks and men are more productive with radio, Tigar has found. Business was increased without adding more men —"saved us the wage of at least 3 pickup drivers and 3 heavy-duty drivers," Tigar asserts.

As for costs, truckers all over the country have found they can have private radio systems for about $1 a day per truck, amortizing the system over a 5-year period. Weighing this cost against earnings of $4 per day (estimating a minimum of one hour extra productivity per day for each truck) gives a 3-to-1 ratio of profit on the radio investment.

Wells Truckways' radio system was installed and is maintained by Mobile Radio, Inc., of Whittier, California, an authorized Motorola Service Station, on a 24-hour basis. Should a truck radio unit or one of the fixed stations require servicing, a phone call to Mobile Radio brings a repairman within a matter of minutes, because the radio men are themselves "radio-dispatched."

Anyone skeptical about radio's value has only to ask President O. P. Wells or Terminal Manager Tigar. In Tigar's words: **"We sometimes wonder how we ever got along without it!"**





Above Left: Mobile radio units are bolted to the wall behind the driver's seat in the truck cab.

Above Right: Dispatcher's messages are relayed to unattended repeater station on mountain top.

Left: Driver is able to talk to any other radio-equipped Wells vehicle in the coverage area as well as to the dispatcher.

MICROWAVE plus CARRIER equals CONTROL

City Public Service Board of San Antonio integrates two forms of communication to provide centralized control of generating and distribution system. By supervisory control, central dispatcher controls 112 circuits in 41 unattended substations, can remotely actuate any breaker along 266 circuit miles of transmission lines.

San Antonio, a city knee-deep in tradition since the days of the Alamo, has gone non-traditional lately in the electric power field.

When the municipally-operated City Public Service Board added two steam generating plants recently, microwave radio was given the job of providing all communication between the central dispatching office downtown and the new power plants north and south of the city.

Microwave was the choice over leased wire lines for the simple reason of its economy, in view of the number of functions performed.

The communication system funnels supervisory control and telemetering information into the Load Dispatcher's Office in downtown San Antonio. Here microwave signals are beamed south 8¼ miles to the Leon Creek Power Plant and north a similar distance to the new North Side plant.

At Leon Creek the microwave is coupled with power line carrier to provide a voice circuit farther south to Pleasanton and Victoria, interconnect point with Central Power & Light Company. The Leon Creek microwave provides (1) a voice channel from central dispatcher to Leon Creek power plant operator, (2) four telemetering circuits, (3) supervisory control, and (4) voice communications to the CP&L dispatcher at Victoria.

The microwave communications load to the North Side plant is heavier. This span provides (1) a telephone voice circuit and (2) an intercom circuit between dispatcher and power plant operator, (3) remote control circuit for our very-high-frequency mobile radio station, (4) supervisory control, and (5) telemetering.

Two legs of power line carrier branch out from the North Side plant, one going 6 miles east to Fratt, a bulk area substation, and the other stretching 24 miles north to the Comal Power Plant, interconnect point with the Lower Colorado River Authority Lines. Via carrier there are voice, telemeter and supervisory control circuits to both Fratt and Comal.

The urgent need for reliable communications between central dispatcher and power plants was pointed up in 1948 during a six-hour outage—a complete breakdown aggravated by erratic communications and lack of isolation facilities. Since that time City Public Service engineers have taken a number of steps to insure that a widespread power failure won't happen again for the same reasons.

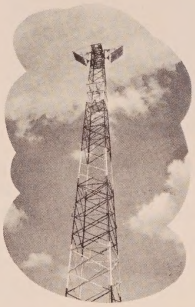
For example, the supervisory control equipment is entirely powered by batteries to enable operation even in cases of full loss of AC power. Isolation points on the supervisory allow sectionalizing load to various power plants in event of out of step conditions, and load dumping points enable load to be dumped if necessary. And as a final precaution, the central station microwave can be operated from batteries by means of a standby generator.

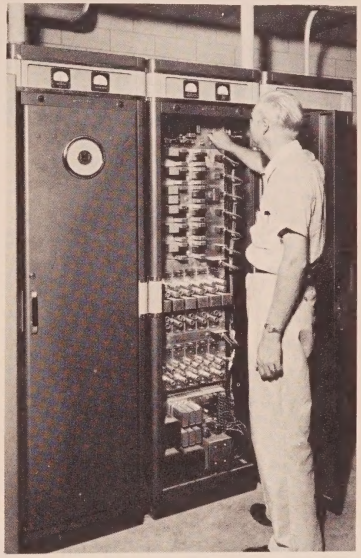
In cases of emergency when the generating plants are isolated, it is important that the dispatcher know the exact frequency on the various lines. To bring this information in by microwave, Motorola provided a special wide band audio frequency carrier transmitter which can be modulated directly by a sampling taken off the generator bus. To recover the information at the dispatching end, Motorola produced a 55-65 cycle amplifier capable of supplying enough power to operate a frequency meter.

Study of topographic maps showed that microwave antennas supported by a 175-foot tower at dispatching headquarters would have line-of-sight clearance in the southerly direction to a microwave dish mounted directly atop the 75-foot-high Leon Creek turbine room, eliminating need for a tower at that station. For the north span, a 100-foot tower was erected on top of the North Side boiler, giving an effective 197-foot elevation there for the microwave reflector.

Results obtained with the integrated communications system have been excellent. Because of extensive pre-delivery testing given the terminal equipment at the Motorola factory, the system went to work immediately upon installation without a shakedown period.

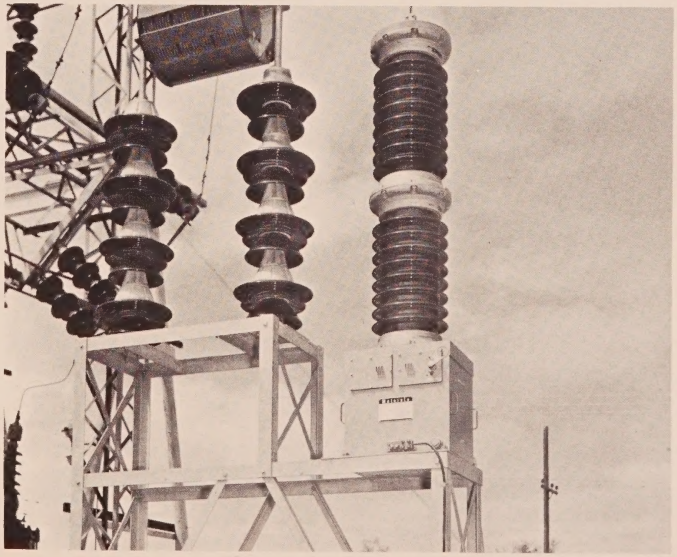
The marriage of microwave and power line carrier appears to hold great promise for power companies interested in economy, widest utilization of transmission lines, and control over their communications from end to end.

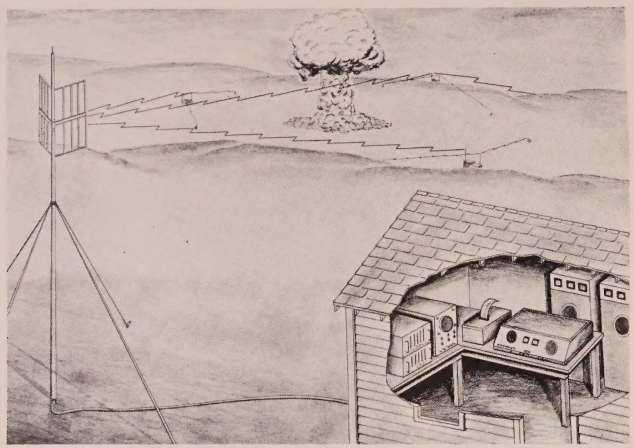




Right: G. L. Fromme, communications engineer, tests multiplexing equipment at North Side Power Plant microwave terminal.

Below: Motorola Aperiodic Couplers of the 138 KV type couple power line carrier RF signals to high voltage transmission lines.





Elevated repeater stations permit radio communication between control station (lower right) and data stations distributed about the center of the explosion.

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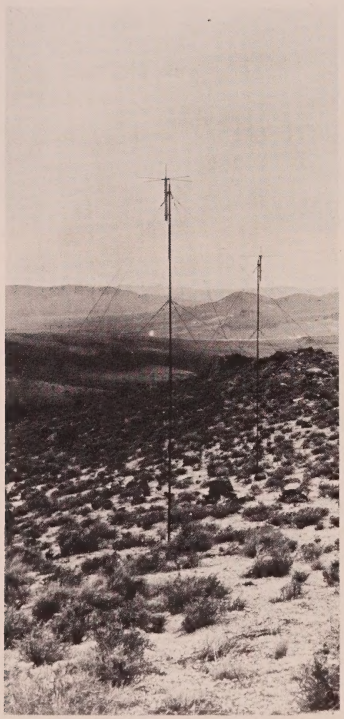


One of the repeater stations of the radiation monitoring system. Transmitter-receiver and associated equipment are in small box midway between the antennas.

MONITORING ATOMIC

With a radio

In conjunction with the Atomic Energy Commission and the National Bureau of Standards, Motorola has provided important units in a remote-control system for monitoring atomic tests.

This much about a wide atomic development program that often goes unheralded because of military security requirements was revealed recently in an NBS report which noted: "The radio link and the station interrogation system were designed and constructed by the Motorola Corporation and are based largely on their ¼-watt portable transmitter-receiver and other standard equipment."

The story of how Motorola came to participate in this work is typical of the background of many other public service projects of this general nature.

Although the Bureau is one of the world's most noted scientific institutions, with a staff of nearly three thousand, Bureau scientists do not seek to establish a group monopoly on their work. The Bureau often has solicited the help of industry and has made its findings available to all, within the limits of military security.

Thus the Atomic Energy Commission called upon the technical resources of NBS to help solve the problem of how to monitor the fearfully powerful release of power attendant upon atomic explosions and the National Bureau of Standards enlisted the specialized experience and equipment of Motorola Corporation for one phase of the project.

Motorola's specialized experience included, for example, development in conjunction with the U.S. Weather Bureau and the Corps of Engineers, of a system of measuring the water content of snow at a remote location and transmitting that information to a central collection center. This system was designed to operate unattended at the remote site, since such locations are inaccessible to pole line facilities.

The environment of an atomic explosion also must be left unattended for obvious reasons, and here, too, radio is the only practical medium for transmitting data to a recording station.

Though developed specifically for monitoring gamma radiation and weather conditions, the atomic explosion monitoring system can be used with a wide variety of detectors to report many types of information. Except for the control station, the entire system is battery powered and will operate unattended for long periods.

Motorola's radio met here is a frequency-modulated system operating in the VHF band between 162 and 174 megacycles. Since line-of-sight transmission is ob-

AN EXPLOSION

remote station interrogation system designed and built by Motorola

On-the-spot check of one of the monitoring data stations.

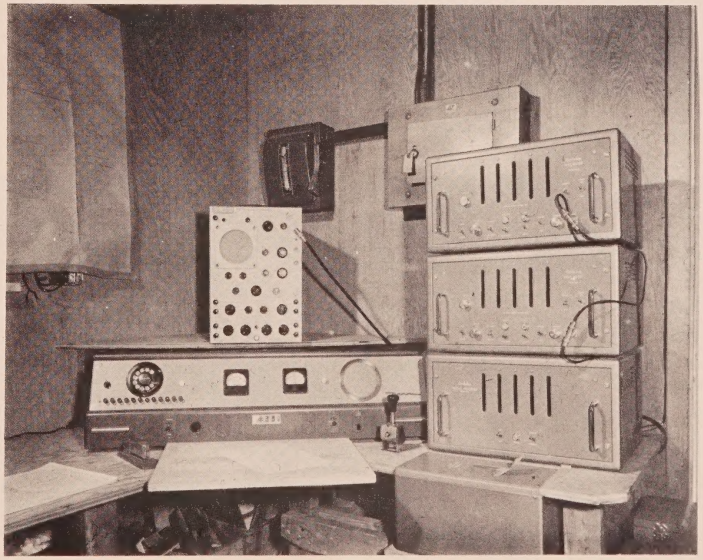
tained at these frequencies, the system employs repeater stations located at positions of high elevation. Each repeater can handle information from 10 data stations, and each data station offers a choice of 10 different programs—each having several functions—which the operator can select for transmission to the control station. Thus, for example, one program might consist of station identification, several calibrations, and radiation intensity readings, while another program might contain weather information. Each data station includes a transmitter-receiver, cycle timer, decoder, program selector, modulator, battery power supply, and detecting instruments.

Finally, in the control station is the console containing 12 push buttons and a dialing system. Ten of the push buttons are for data station selection; the remaining two are used to select the desired receiver and transmitter at the repeater station. The dial is for choice of data programs.

This, of course, is an over-simplified explanation of the electronic monitor—yet the man in the control room can dial in on an atomic explosion, as the mighty force is released far away, almost as simply as you might dial the weather or the time on your telephone.

The "horse and buggy" days of atomic energy are recent, dating back some say only to about 1934 when the first cyclotron was producing useful quantities of radio-active materials; about a decade later the deadly mushroom of the atomic bomb came to symbolize an era; now, only a second decade from the beginnings, scientific man can sit calmly and safely at a remote-control console and "listen in" on atomic explosions.

Control station transmitting-receiving antenna (center).



Motorola remote control console (left) has push buttons for data station selection and a dialing system for choice of data programs.

FIRE TRUCK LADDER SERVES AS EMERGENCY MAST

An idea developed by a Chicago radio engineer may mean the difference between solid communication or the lack of it in future disasters.

Joseph M. Hadfield (left), consulting engineer to Chicago Fire Department, demonstrates use of fire truck ladder as antenna mast to George Iding, 2nd Division marshal, Fire Commissioner M. J. Corrigan, and Chief Fire Marshal Albert Peterson.

Photo Courtsey "Chicago American"

Joseph M. Hadfield, radio consultant to Chicago Fire Commissioner M. J. Corrigan, hit on the idea of utilizing the Fire Department aerial ladder as an emergency antenna support for fire and police radio stations in case the regular tower is knocked out.

Tests conducted in Chicago and Milwaukee have proved the plan to be thoroughly workable.

This means any city with a ladder truck can erect its own transportable antenna mast with as little as 10 minutes of make-ready time.

Required are an antenna which can be clamped or taped to the ladder top, and a 75 to 100 foot roll of coaxial cable for the feedline. Hadfield uses a "Unipole" ground plane antenna, fed with RG8/U cable. The radio can be either the fire truck transmitter or a fixed base station transmitter.

During the Chicago tests, output of a standard Motorola 30-watt fire truck transmitter was connected to the antenna elevated 68 feet. Signals were clearly heard in a cruising chief's car 90 blocks away—more than 11 miles. Hadfield and Norman Biorn, Fire Department radio technician, reported solid reception at every point along the city's boundary.

In the Wisconsin tests run by Hadfield and Henry Barnes, assistant superintendent of Milwaukee police and fire communications, a 10-watt Motorola fire truck unit was used as the temporary base station. Reception generally was very good, with only one area noted where the noise level was high.

The Milwaukee tests were requested by Fire Chief Edward E. Wischer under a mutual aid agreement by which Chicago and Milwaukee operate their fire radios on a common frequency, enabling quick interchange of equipment as needed.

Although the most obvious application of the ladder antenna is for Civil Defense and disaster uses, it applies equally well to routine tasks such as antenna site testing and field strength measurements. In fact, it was Hadfield's need for a temporary antenna tower in testing the location of a proposed fire station that led to the first experiment.

Rx RADIO

. . . benefits both patient and doctor in routine as well as emergency cases.

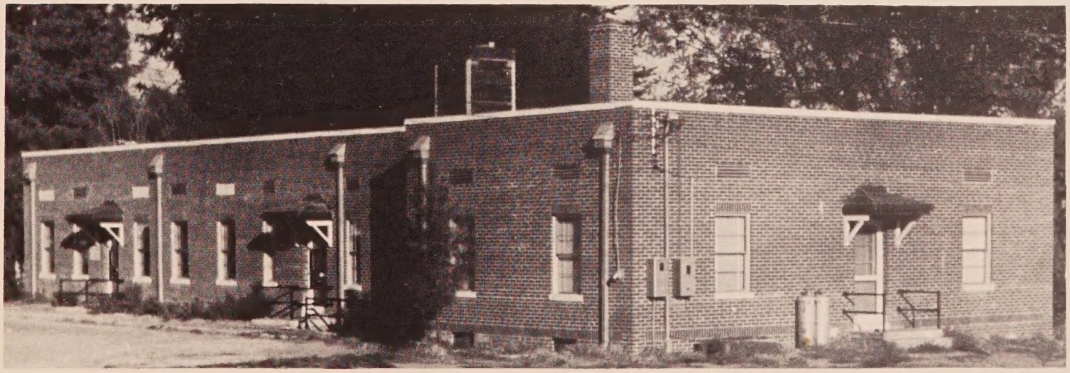
Dr. Scott and nurse Nancy Walker Kistler, who is one of the more than 6000 persons he has brought into the world.

Invention of radio communications has made life easier in many ways, and Dr. S. Floyd Scott of Union Ridge, N. C., has found that it also makes his practice a more efficient one.

Dr. Scott, who has practiced general medicine in the Union Ridge area since 1919, has two jeeps for making calls. Each is equipped with two-way radio so that when emergencies come, he is right there.

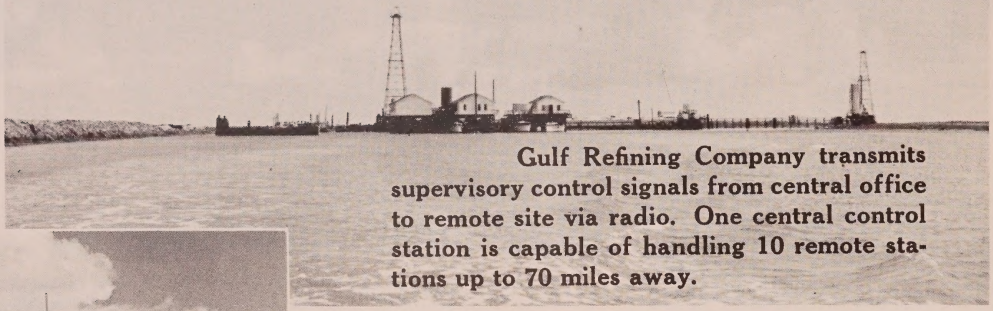
Installation of two-way radio has been one of the greatest gains during the years of his practice. He covers an area of about 25 miles in radius and is out in the country every day. If someone queries the nurse at the clinic, she just turns to the radio and calls Dr. Scott. He then visits the patient without coming back to the office, thus saving himself considerable time. If he is needed on an emergency case he can be radioed and can be there in a matter of minutes. It is a satisfaction to both the doctor and the patient to know that radio is being used.

His time-saving two-way radio system was installed in 1949.



Dr. Scott's modern medical clinic is the central station for the Scott radio system. The clinic was built in 1949 and houses the offices of Dr. Scott and his sons and a drug supply room.

Remote Supervision and Control of Oil Well Production



Gulf Refining Company transmits supervisory control signals from central office to remote site via radio. One central control station is capable of handling 10 remote stations up to 70 miles away.

A prediction of things to come is the new automatic remote control system being used by Gulf Refining Company at its Timbalier Bay field in Louisiana. Located along the Gulf of Mexico 60 miles south of New Orleans, this field provided an excellent location to try out a remote supervisory control system utilizing VHF radio to transmit supervisory and control signals from a central office to the field. Voice communications are also transmitted by radio.

Although the field is only two or three miles away from the central office, much of it is covered with water. Consequently, boat is the only means of transportation, and in bad weather, travel is impossible or unsafe at best.

The decision to employ radio eliminated the need for stringing connecting wires and precluded possible trouble as a result of storms.

At Timbalier Bay, the tank battery is actually a barge containing six oil storage compartments. There are four separators —three low pressure and one high pressure—to separate gases from the oil produced by ten wells.

The supervisory control system is tied in with a unique method of automatically controlling the tank battery and production. The operator in the central office not only supervises the operation of the automatic control system in the field, but can control field operations when he desires.

Automatic Production Control

Flow lines from the wells are equipped with electrically operated "fail safe" motor valves. If the liquid level in any of the separators reaches the point of overflowing or carrying fluids into the gas line, a float switch is actuated. This switch breaks the circuit that provides current to keep the flow line motor valve open, and the wells are shut in.

Wells are also closed in by float switches on the tanks. To prevent wells from shutting down as soon as one tank is filled, Gulf Oil uses a unique tank switching device called the Robertson Electric Tank Switcher after its inventor, M. L. Robertson of Gulf's East Texas Zone headquarters at Kilgore. After a tank is filled, the switching device closes the valve in the fill line of that tank and then opens the fill line of the next empty tank. This process is repeated until all of the tanks are filled, at which time the wells are automatically closed in.

When a tank is emptied into the pipeline system, a switch on the pipeline valve closes the fill line valve to that tank. The automatic tank switching device will pass that tank and go on to the next one which is not full. The pipeline valve switch and the float switch on the tank are connected in series, so that they provide the same control action.

Supervisory Control

The operator at the central office, besides having a channel for voice communications, is given the following information by means of lights on the supervisory control console:

Wells open or closed
High fluid level in the separators

Empty, filling or full indication for each tank
Tanks full indication

In addition, lights on the console indicate when power in the field is being supplied by a gas turbine generator (using separator gas from the producing wells) and when an engine generator (used to start up the control system after wells have been closed in) is operating.

The above indications enable the operator to supervise the position of the remote equipment. He can also send signals to the field to control the following operations:

Remote power on or off
Wells open or closed
Tanks full reset

Once the field has been completely shut in, the operator starts up operations by pushing a start button on a control panel at the central station. This starts the gasoline engine-driven generator at the remote station. After equipment for the supervisory control system has been warmed up, the operator makes a complete check of all functions indicated on the supervisory control console, resets the control panel and pushes the "wells open" button.

If all of the tanks are not full and none of the separator liquid levels are too high, the automatic production controls will then take over. In practice, time delay mechanisms in the electrical circuits to each individual flow line motor valve control the opening of each well so that no two wells begin flowing at the same time.

With the wells open, separator gas accumulates until its pressure is sufficient to operate the gas turbine. The gas turbine then starts up and the standby generator automatically stops.

Once the system is operating, automatic controls take over. Tanks are automatically switched and indications are transmitted to the central control station when a check is desired. Should any of the supervisory functions close-in the producing wells (high fluid level in the separators, or all tanks full) such conditions are reported back to the central control station.

The wells will remain closed in until all supervisory stations are back at their normal levels—separator level below the danger point, stock tanks not all full. Then to place the automatic controls back into operation and open the flow line motor valves, it is necessary to reset the control system by means of the manual reset switch.

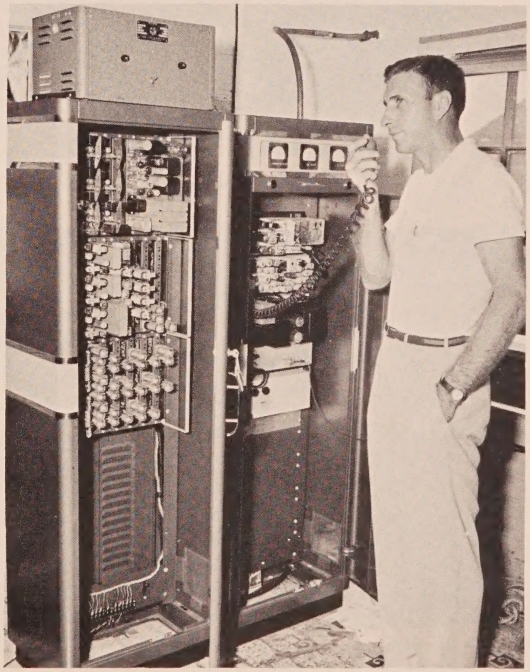
Future Uses

Gulf's remote automatic production controls at Timbalier Bay have been in operation for a number of months . . . enough time to show that the system is practical. This installation, in which the field is only two or three miles from the central office, is expected to be the forerunner of future remote control systems employing radio transmission between an oil field and a central control station located up to 70 miles away. Its versatility makes it possible to include up to 90 control and supervisory functions and to handle as many as 10 remote stations from one central control station. Supervisory control without wire lines will be a real aid to companies who plan to have fields in the continental shelf of the Gulf.

A more detailed description of Gulf Refining Company's operation at Timbalier Bay appeared in the November, 1954 issue of WORLD OIL. Reprints of this article can be obtained by writing to Motorola.

Engineer Ellis Norwood at central control station talks with field personnel. Equipment here is duplicated in the field.

All control and supervisory control functions are indicated on console being used by Eddie Hannahan, Gulf Refining Company field engineer.



In the Cicero office, orders for parts are received, processed, and then given to order pickers.

. . . The Keynote of Motorola's Parts and Service Operations

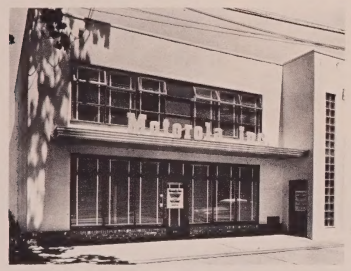
Filling orders for replacement parts, kits and assemblies as quickly as possible is the aim of Motorola's three Parts and Service Departments in Chicago, Dallas, Texas and San Mateo, Calif. It is hoped that the photos on these pages will give an insight into the special efforts made to handle orders and requests for parts, information, engineering assistance and factory warranty service.

The magnitude of the task can be illustrated by a few facts about the Cicero Ave. (Chicago) Department, where the interior photos were taken. More than 15,000 parts and assemblies are listed on its books, with some 8000 items actually carried in stock. Kits are also a major item; in 1954 more than 800 different types were sold.

In spite of the tremendous bookkeeping and stock handling problems, latest figures show that the staff of 60 fills and ships on the same day about 30% of that day's orders. About 70–75% of all orders will have been shipped within 24 hours of receipt.

Orders received by telegraph or telephone are assigned a priority number, and most emergency orders are dispatched within two or three hours.

Among the Service Department functions are the handling of equipment warranties, servicing of customer equipment, building parts that are no longer in factory production, and rebuilding to factory standards equipment received as trade-in. The department stands by on an emergency basis at all times and is capable of servicing any two-way radio equipment ever built by Motorola.



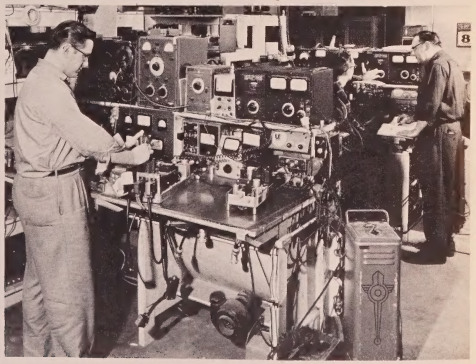
SAN MATEO PARTS AND SERVICE DEPOT.

CHICAGO PARTS AND SERVICE DEPARTMENT.

DALLAS PARTS AND SERVICE DEPOT.

Two girls spend full time making kits for conversion of 6-volt units for 12-volt operation.

Highly experienced servicemen at four test positions analyze sets for troubles and pass them on to . . .



. . . Girls on this line who replace parts and rewire sets when modifications are indicated.

Recent innovation is the use of "grocery" carts to speed order picking and to keep small parts together.

NEW BANKING TECHNIQUE FOR FARM SALES

In the cold, blistery months during which farms sales are usually held, both farmers and those handling the auction are happy to complete the sales and head for the warmth of the indoors. For this reason, Peoples State Bank, Thompson, Iowa, is using Motorola portable "Handie-Talkie" radiophones to expedite the transactions.

The accompanying photos were taken at a farm sale held on the Helmer Skogen farm, Forest City, Iowa. As Ben Reemsma, auctioneer, made the sales, Bruce Osmundson, cashier, radioed the pertinent information to Orville Sill, teller, who maintained an "office" in a car parked nearby. Sill recorded the information and radioed back whenever he had any questions. After the farmers made their purchases, they settled for them with Ernest Osmundson, bank president, who was also in the car.

The success of this new banking technique led Bruce Osmundson to say, "In our opinion, this is the perfect way of handling farm sales."

Bank cashier Bruce Osmundson radios information on a sale just made by auctioneer Ben Reemsma.

Orville Sill, teller, then records the information and the farmer comes to the car to complete the transaction.

Two bottom photos show Ben Reemsma getting the bidding started at an auction held this past winter. Cold weather that is so typical of farm sales is an incentive for speeding up transactions.

WINTER PROVIDES THE ACID TEST

"Slapped by an unexpected blast of winter weather which struck suddenly Friday evening with blinding flurries and gusty winds, Traverse City, Michigan, and the surrounding region dug out from beneath a five-inch blanket of heavy snow which filled side roads and slowed traffic to a crawl.

"On Saturday a freezing drizzle fell and of the equipment, pointed out that before the sleet turned to snow, creating slippery spots on regional highways No let-up was in sight."

Just such conditions as these repeatedly provide the acid test for Grand Traverse County's radio-equipped highway equipment. But radio proves its worth as it enables Sid Medalie, county highway superintendent, to quickly dispatch road units where they are most needed, and with no delay.

Medalie, in commenting on added efficiency of the equipment, pointed out that before the installation of Motorola two-way radios, snow plows, sanders and other units would go out on an assignment and would be out of touch with the office until an assignment was completed or a cruiser car made contact. Under the present system—in effect for one year—a sanding truck can be dispatched to an assignment and then sent to a new emergency spot directly from the main office.

Eleven mobile units in various pieces of highway equipment have instantaneous radio contact with a base station unit in the main office of the county highway department. Remote control units in Superintendent Medalie's office and in the repair department facilitate operation when the main office is closed.

Two-way radio also has advantages for the workmen. Before its installation, workmen at remote locations of some of the highway networks were often handicapped by lack of communications with the main office. This problem no longer exists. The men are as close to the office as the microphone on the dash of their trucks.

The installation of radio-equipped road units has made it possible to put winter traffic conditions in Grand Traverse County second to none in Michigan.

(Record-Eagle Photos)

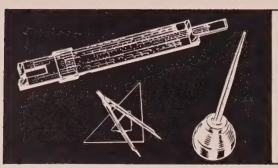
One of the 11 Grand Traverse County vehicles which are equipped with two-way radio.

(Record-Eagle Photos)

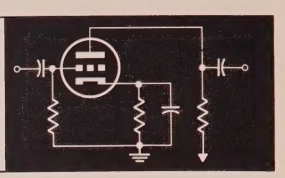
In the county garage building, Mrs. Harley Lewis, operating the base station, makes contact with a snow plow.

(Record-Eagle Photos)

Sid Medalie, county highway superintendent, has instant contact with all of his men.

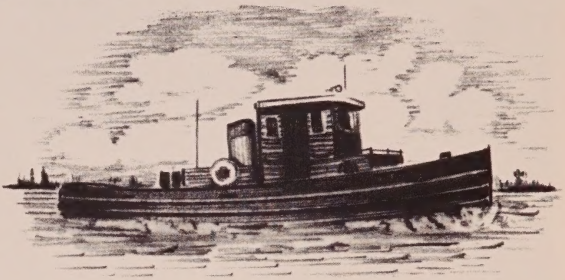


Technical Notes Section



VHF MARINE RADIO APPLICATION

This new 4-channel two-way radio utilizes the advantages of the VHF maritime FM frequencies to provide superior communications for lake, harbor and coastline operations.



Motorola's new FM Marine radio unit operates on the VHF maritime frequencies (156.3-157.4 mc. and 161.9-162.0 mc.) which have several advantages over the lower maritime AM frequencies (450-500 kc. and 2-3 mc.) in this type of application.

1. The working range of these VHF frequencies (20-50 miles for a typical Motorola installation) is ideal for harbor and coastline operations, yet seldom results in overlapping signals on interfering frequencies—a phenomenon associated with the long distance propagation characteristics of lower frequencies.

2. Man-made interference is much less at the VHF frequencies than at lower frequencies.

3. FM equipment is used on the VHF maritime frequencies as opposed to AM equipment which is used on the lower frequencies. The "capture effect" of FM prevents weaker undesired signals from interfering with a stronger desired signal, and FM is virtually immune to man-made and atmospheric interference.

FREQUENCY ALLOCATION

Current frequencies allocated by the F.C.C. are spaced 100 kc. apart and are allocated to government (Coast Guard), safety and calling, ship-to-ship communications, port and harbor control, business and operational, and public correspondence applications. Any ship may be allocated as many channels within the frequency range as required for its operations. All stations on shipboard (except for portable low power "marine utility" stations) are required to have facilities for transmission and reception on at least three channels—a "safety and calling channel" (156.8 mc.); a ship-to-ship channel (156.3 mc.); and a ship-to-shore channel of any type including Coast Guard, business and operation or public correspondence channels, unless specifically excluded in the F.C.C. rules for a particular application. Motorola VHF Marine radio equipment provides single-switch selection of any four of these frequencies.

Frequencies authorized for business and operational purposes are intended primarily for ship-to-shore communication but can be used on a secondary basis for ship-to-ship communication relative to the safety, or business and operational needs of the ships—providing the ship-to-ship communication does not willfully interfere with or delay any communication between ship and shore. Vessels which navigate primarily within harbor or port areas are assigned a different frequency from vessels which navigate primarily between or outside harbor and port areas.

In addition to the above channel, a channel is available for communication solely in connection with harbor or port operations such as docking, lighterage, pilotage, dredging, towing, ship repair, port development, maintenance of navigable channels, and for communication concerning the passage of vessels through locks under government supervision. A frequency is also available for assignment primarily to ship stations on board pilot vessels normally stationed at the entrance to a harbor or port to supply information concerning the arrival and departure of ships.

SAFETY AND CALLING CHANNEL

The purpose of the 156.8 mc. safety and calling channel is to insure that all vessels will be able to contact all other vessels and shore stations at any time, whether they are in their "home" waters or not. Except for short messages, contact is made on this frequency only to determine on which channel contact can be established for further communications. Assurance of contact is essential to marine operations for control of conflicting movements of ships, for harbor control in

"away from home" ports, and particularly for emergency and distress traffic. The only way this contact can be assured for a ship wherever it may be in the U. S. inland waterways, in coastal waters or ports is to establish a common nationwide channel for this purpose—the safety and calling channel.

EQUIPMENT

The basic equipment consists of a radio set in a standard Motorola 15-inch mobile housing, and a cable-connected control unit. The radio set includes the same basic transmitter and receiver chassis used in the standard Uni-Channel mobile equipment, and a 117 volt 60 cycle power supply. The transmitter has a 20 watt RF output on any frequency in the 156.3-157.4 mc. band. The receiver has a selectivity of —100 db. at ±32 kc. Although it is designed for the 1.1 mc. wide maritime frequency band, this unit can also be used for other multi-channel applications within the 144-174 mc. land-mobile frequency band.

The control unit is specifically designed for the operating requirements of a shipboard installation. The rugged cast aluminum housing is rubber gasketed at all openings for full all-weather protection. It can be mounted within easy reach of the operator on the bridge or at any other operating position. Volume, squelch and channel selector controls plus three pilot lamps are included. The radio equipment, connected to the control unit by weatherproof cable, can be mounted in any convenient location—up to 50 feet from the control unit if required.

AUTOMATIC REVERTING

An important feature of the control unit is the automatic reverting function—i.e., it automatically returns the equipment to the safety and calling channel frequency when the handset is placed in the hang-up cradle. Human error is eliminated—the safety and calling channel is always monitored when the radio set is not being actively used for other traffic. Furthermore, the equipment remains on the safety and calling channel even if the handset is removed from the hang-up cradle—until a "channel transfer" toggle switch is momentarily depressed to change to that frequency selected by the rotary channel selector switch. A simple lug change, accomplished with only a screwdriver, adapts the equipment to employ any other channel as the reverting channel to meet specific operational requirements.

ACCESSORIES

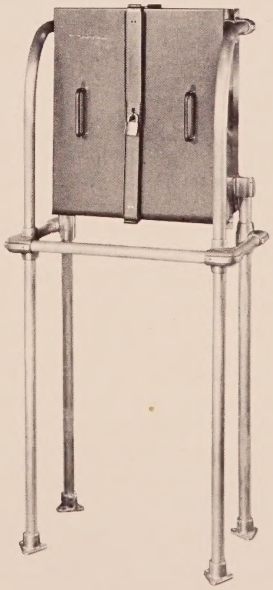
A complete line of accessories for this unit is available to adapt to almost any type of installation. The control cable is supplied at the required length for the specific installation. A Motorola "Isoplane" type antenna is designed especially for marine use. Many other types of antennas are also available. A weatherproof housing provides additional protection against salt water conditions. A universal stanchion mounting kit enables bulkhead, deck or overhead radio set mounting. Where 117 volt 60 cycle power is not available, voltage regulating inverters are also available for operation from the DC voltages conventionally used on board ship.

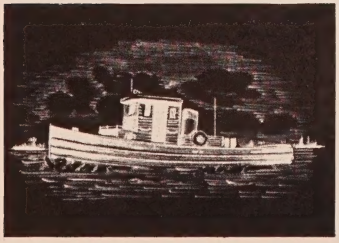
Motorola also provides two-way radio for the maritime frequencies at approximately 35 mc.

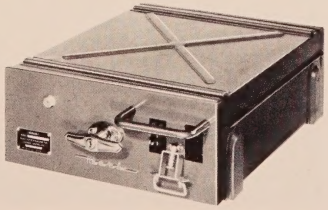
WEATHERPROOF HOUSING AND UNIVERSAL STANCHION MOUNTING PERMIT INSTALLATION ANYWHERE ON OR IN THE VESSEL

WEATHERPROOF CONTROL UNIT

RADIO SET IN STANDARD 15-INCH DRAWER







SERVICE HINTS and SHOP NOTES

BATTERY CHARGER

The P-9010 Battery Charger provides the proper rate of charge for 2-volt storage batteries of the type used in "HANDIE-TALKIE" FM Radiophones. The unit has facilities to charge from one to four cells simultaneously. The P-9010 circuit, as shown below, contains a multiple-tap line input transformer, four selenium rectifiers arranged for full wave rectification and four pairs of polarized battery terminals.

The normal charging rate of the P-9010 varies between 1.2 and 0.9 amperes depending upon the primary power tap selected, internal resistance, initial terminal voltage and general charge condition of the battery. This rate decreases as the selenium rectifiers age, but normally can be restored by moving the power input connection to the next lower voltage tap. When the normal charging rate cannot be restored by using the lowest tap, and assuming that the decreased rate is not due to aging of the batteries, the selenium rectifiers should be replaced.

The charging current should never exceed 1.2 amperes at the risk of overcharging the batteries. Overcharge is indicated by a noticable increase in electrolytic bubbling activity.

A good indication of full charge is zero increase of battery terminal voltage over a 2-3 hour period of charge. Terminal voltage at full charge is in the range of 2.15 to 2.2 volts.

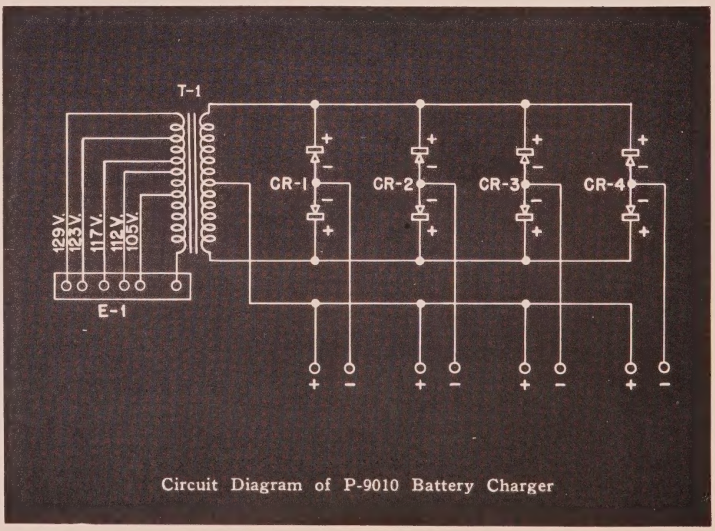
RECTIFIER TUBE

Because the 866A Rectifier Tube is a mercury vapor tube, its cold weather applications are limited by the freezing point of mercury. At stations where the temperature continually falls below this point, the 866A should be replaced by its "cold weather" counterpart, the 3B28. The 3B28 carries a temperature rating of −75° C. to +90° C. In view of the significant cost differential, however, the 3B28 does not possess sufficient advantage over the 866A to warrant replacement at temperatures normally encountered at most points in the United States.

PA LOADING

The instruction manual procedure for loading the transmitter final amplifier in the T33G and T43G Series Mobiles states that the final amplifier should not be loaded to a meter reading of more than 30 microamperes. The figure 30 microamperes, as indicated in the manual, is the maximum safe plate current for the amplifier tube. This should **not** be interpreted as an average figure, or as a minimum figure which must be reached to achieve rated power output.

It is not possible to publish an exact figure for final amplifier plate loading which will hold true



Circuit Diagram of P-9010 Battery Charger

for all transmitters because of the many variables which enter the picture. Tubes vary considerably as to the point at which maximum power output is obtained, as do circuit constants, voltages, etc. The following notes help to clarify this point.

(1) The PA reading (30 ua), as stated in the manual, is the maximum plate current rating of the amplifier tube and should never be exceeded.

(2) Most transmitters will achieve rated power output at a PA loading of less than this maximum figure. As a matter of fact, the lower the value is the better, since a lower reading indicates better power amplifier efficiency.

(3) The readings given in the manual for meter positions 3, 4, 5 and 6 are minimum values which provide just enough drive to produce rated power output. Normally, the transmitter will have enough drive to exceed these values.

RAILROAD KITS

Two new kits have been made available to supply replacements for certain mechanical components of railroad radio equipment mounting racks. These kits are the SK9431 Rubber Bumper Replacement Kit and the SK9432 Shock Mount Replacement Kit.

The SK9431 contains one of the rubber bumpers and mounting hardware which aid in holding the transmitter, receiver and power supply units securely in the mounting rack. When normal wear necessitates replacement, the bumper and hardware contained in the kit permit direct mechanical replacement on any Motorola railroad type mounting rack, including earlier models where plastic coated springs were used as bumpers.

The SK9432 Shock Mount Replacement Kit provides replacement for all four shock mounts of the type used on 3-unit vertical, and 4-unit square mounting racks. (They do not replace the type used on the 3-unit horizontal rack.) When a single shock mount requires replacement, all four units must be replaced in order to maintain balanced loading and maximum possible effectness.

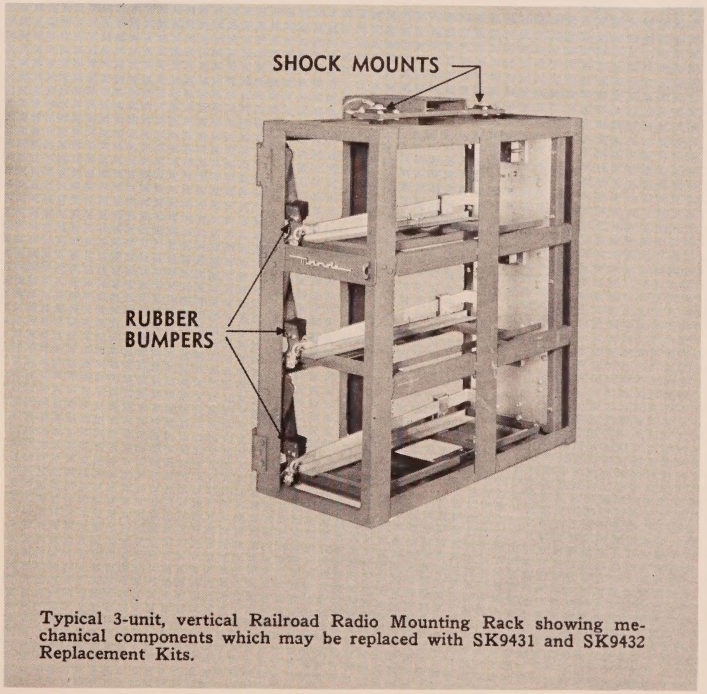
For this reason, the SK9432 provides not one, but four, shock mounts along with the necessary hardware.

The location of the bumpers and shock mounts on a 3-unit, vertical rack are shown below. The bumper replacement kit is applicable also to the horizontal and square type racks. The shock mount kit replaces the shock mounts on the vertical and square type racks.

SQUELCH CONTROL

From Charles F. Meyer,' of Phoenix Radio Message Service in Phoenix, Arizona, comes word of a novel method of remotely controlling a receiver squelch setting. Mr. Meyer's arrangement uses a QUIK-CALL tone signal to control a small synchronous motor connected to drive the squelch knob on the remote receiver. He has fitted the motor drive shaft with an arm and drive pin which runs in a slotted arm clamping the squelch knob. When the tone signal is received, a special Vibrasponder control circuit is used to start the motor. By using the proper combination of motor speed and arm travel, the squelch setting can be opened and closed once per revolution. As Mr. Meyer says, ". . . one simply has to develop the touch for proper adjustment."

★ ★ ★



Typical 3-unit, vertical Railroad Radio Mounting Rack showing mechanical components which may be replaced with SK9431 and SK9432 Replacement Kits.

NEW MICROWAVE PRODUCTS . . .

. . . FIXED AND PORTABLE

"Network Quality" transmission of monochrome and

The exceptional performance characteristics of these new fixed and portable microwave packages qualifies them for feeding TV signals into coast-to-coast networks —as well as from networks to remote TV stations, and for local "STL" (studio-to-transmitter) applications. The equipment operates on STL and common carrier frequencies in the 6,000-7,000 mc. range and is similar to the Motorola microwave equipment providing reliable 24-hour operation over more than 6,000 miles of industrial point-to-point communications.

ANTENNA SYSTEM

An aluminum parabolic reflector and an associated waveguide "hook feed" focus the microwave energy into a narrow 3-degree beam. This beam is directed in a "line of sight" to the distant microwave receiver. When additional height is necessary to obtain this line of sight condition, the antenna directs the beam vertically to a 45-degree tower-mounted reflector which refocuses the beam and contributes to the antenna system power gain. All operating equipment is at ground level for easy servicing. Transmission lines to the top of the tower—with associated signal loss and maintenance expense—are eliminated.

PORTABLE EQUIPMENT
complete transmitting or receiving terminal in easy-to-carry weatherproof packages

CIRCUIT DESIGN

Circuit design of both the fixed and portable packages is similar. The TV video signal is used to frequency-modulate the microwave carrier, and an FM subcarrier provides a high-fidelity audio channel. Highest quality components are conservatively operated for long trouble-free equipment life—klystron tubes have exceeded 20,000 hours of continuous operation in customer installations.

Performance specifications meet or exceed FCC, NTSC, and proposed RETMA requirements—frequency response is ±0.1 db. from 30 cps. to 300 kc. and no more than ±0.5 db. to 4.3 mc., differential gain is less than 0.5 db., and differential phase is less than 2 degrees. A pre-selection filter in the receiver waveguide prevents any possibility of adjacent microwave channel interference. A built-in modulation tester permits rapid, accurate adjustment of system modulation and gain levels, and a built-in cable equalizer provides flat frequency response by compensating for video cables at both the transmitter and receiver sites.

Both the transmitter video input and the receiver video output circuits accommodate 124 ohm balanced or 75 ohm unbalanced

TV RELAY
color TV programs

line operation. Both the transmitter and receiver contain alarm circuits which provide a pair of closed contacts for an external alarm device in event of an RF equipment failure. The microwave receiver contains a phase equalizer circuit to minimize the differential phase characteristic of the microwave system.

PORTABLE EQUIPMENT

The portable equipment is packaged into easy-to-carry units for convenience in setting up temporary remote pickups. A transmitting or receiving terminal consists of an RF case, control case, power supply case, tripod, and cable reel —each weighing approximately 50 pounds—plus a 40-inch diameter antenna which weighs approximately 25 pounds. Antennas are also available with 20-inch and 72-inch diameters. The equipment can be left unattended and is designed for all-weather operation.

The folding tripod has a sturdy center post with a tie-rod connected to each leg for extra rigidity and stability. Individual leg calibrations, and degree scales for tilt and rotation (360 degrees) aid in positioning. The RF equipment case mounts on the tripod. The paraboloid is attached to the case by means of a dovetail-fitted plate which is easily engaged and locked into position.

The control case and power supply case are connected to the RF case by a single 100 foot multiconductor cable, permitting remote operation of the RF equipment. A 10 foot power cord connects the control unit to any conventional 117 VAC outlet. All external electrical connections are terminated on the control case. The equipment in the control and power supply cases can be mounted on a 19-inch rack and a bracket is available for rack-mounting the RF equipment.

FIXED EQUIPMENT

The fixed equipment is designed for continuous operation. All of the RF equipment is mounted on a frame of extruded aluminum channels and is protected from the weather by two rib-reinforced aluminum doors. A 40-inch or 72-inch diameter antenna mounts in a vertical or horizontal position on top the housing. Both the housing and antenna are available with anodized aluminum surfaces for added protection against corrosive atmospheres such as salt air.

The RF equipment is packaged in two plug-in boxes, each of which is placed on a separate "elevator" platform and raised into position by an associated hand wheel. One box contains the transmitter or receiver and associated control panel, and the other box contains the power supply. Terminal equipment (input and output line amplifiers and associated power supplies) is not contained in the weatherproof housing but is mounted indoors on a 19-inch rack. There are 5 rack units (8-¾") of video terminal equipment at the transmitter site and 11 rack units (19-¼") at the receiver site.

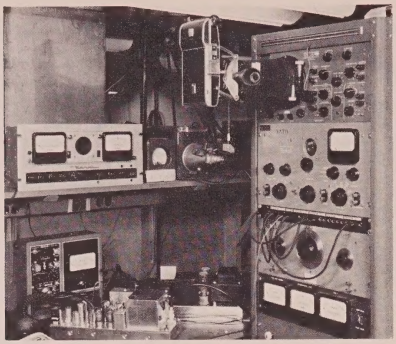


Fig. 1 Laboratory Bench Test Set-up for Deviation Measurement Demonstration

Recent field engineering investigations have traced certain types of system degradation to improper measurement and setting of transmitter modulation levels. Although these situations were readily rectified, they point up a serious need for better operational understanding of the Motorola modulation-frequency monitor and its characteristics.

LET'S MEASURE MODULATION

by FRED HILTON
Manager, Transmitter Development Motorola, Inc.

Accuracy of test equipment is of primary importance to any user of radio communications equipment. Of equal importance is knowledge of the characteristics of the measuring equipment under various conditions. As the case in point, the Motorola frequency and deviation monitor is the leader in the field with respect to accuracy under conditions of variations in RF signal level, line voltage and other environmental conditions. In common with other meters, however, it has the characteristic of responding differently to different wave shapes. The meter movement actually responds to **average** voltage but the meter scale is calibrated in terms of **peak** value of a sinusoidal signal. When the input waveform departs from that of a sine wave, the meter will read high if the average-to-peak voltage ratio increases. Conversely, if the energy level of the waveform is low, i.e., if the average-to-peak value is low, the meter reads low.

The illustrated laboratory set-up shows the test equipment used for this demonstration. A standard Motorola 30 watt transmitter was used to generate the test signal. On the shelf above the transmitter is the Motorola monitor and at the right is a lab test rack containing a 5 inch oscilloscope equipped with a recording camera. This 'scope was connected across the discriminator output of the monitor. Meter readings and oscillograms were taken simultaneously. Fig. 2 shows the results when a 1000 cps. signal is fed to the transmitter at a level which produces 10 kc. deviation. The 'scope has been calibrated to show 1 kc. deviation per square. With the pure sinusoidal input, the 'scope shows 10 kc. deviation (10 squares) and the meter on the monitor reads exactly 10 kc. deviation.

Now the input level is increased until the monitor reads 15 kc. (Fig. 3). Note that the deviation as read on the 'scope is only 13.5 kc. The waveform departs from a pure sine wave as the IDC action starts since the transmitter has been set to limit deviation to 15 kc. and the average energy in the waveform is higher than that in a sine wave so the meter reads high.

Increasing the input level to achieve the full 15 kc. peak deviation as read on the 'scope (Fig. 4) causes the monitor to read 19.5 kc. (average energy still higher than in Fig. 3).

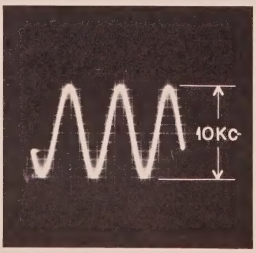
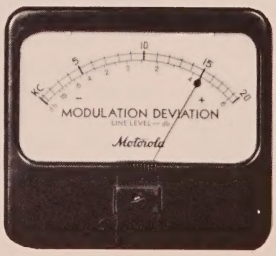


Fig. 2 RETMA Standard Sinusoidal Input at 1000 cps.



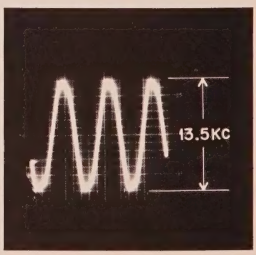
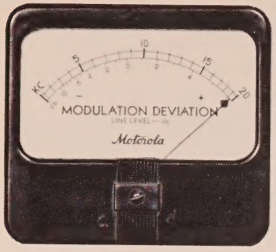


Fig. 3 Deviation at Limiting Threshold at 1000 cps.



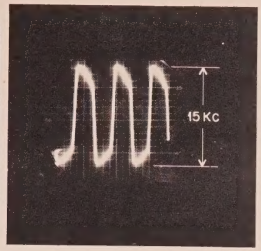
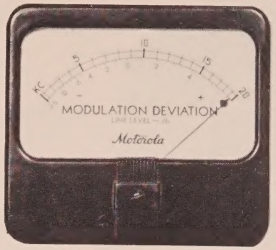


Fig. 4 Full Deviation Input at 1000 cps.



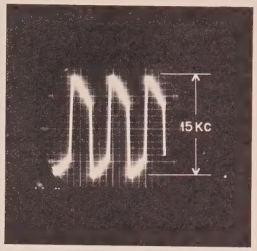
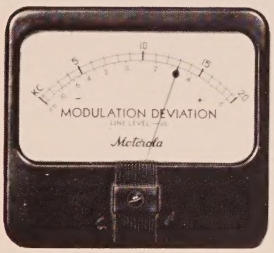


Fig. 5 Excessive Limiting Action at 1000 cps.

As a further test, the audio input is increased by 20 db. (10 times) but the deviation shown on the 'scope and on the monitor does not increase (Fig. 5). The IDC is holding the deviation constant in spite of an extremely high input level and the energy in the waveform is at its maximum value. The waveform is not quite square because the receiver used is incapable of passing the highest audio harmonics without phase shift. The audio input could be further raised to 30 db. (30 to 1) above limiting threshold but the deviation still will not exceed 15 kc. With a properly set IDC control, it is impossible for the transmitter to over-deviate.



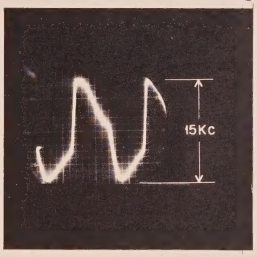


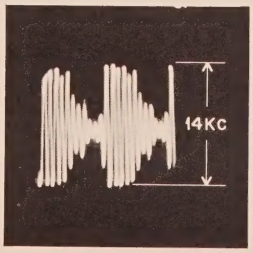
Fig. 6 Full Deviation Sinusoidal Input at 500 cps.

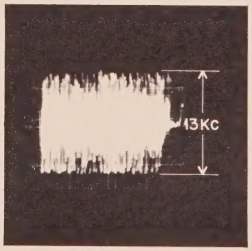
For further illustration, a lower frequency audio signal is fed to the transmitter. At a frequency of 500 cycles the input level which produces a 'scope reading of 15 kc. results in a monitor reading of 13 kc. (Fig. 6). The average energy level is now less than the average energy of a sine wave. The distortion in the clipped waveform is because the transmitter modulator is operating near its maximum phase shift capabilities. At 250 cps. this effect would be even more pronounced.

In actual performance, voice modulation is more important. The effect of a sustained "ah-h-h-h-h" spoken into a microphone is shown in Fig. 7a. Figure 7c. shows ordinary speech. Both produce the same meter reading. The low average-to-peak ratio of both waveforms show why the meter reading is generally low on speech input. Meter ballistics have a further effect. Speech is a combination of individual short sounds separated by relatively long intervals. Due to the inertia of the meter, a finite time is required for the meter to respond. Hence, the meter needle generally starts to move about the time the voltage is removed from the meter. These two effects add to produce a low meter reading. Thus an oscilloscope is the only wholly reliable deviation indicator since it is instantaneous in action and the peak reading is unaffected by waveform.

The problem with a 'scope is in its calibration, and this is where the monitor comes in. Remember that with a sinusoidal input, the monitor reads accurately. Therefore, in systems where the deviation is 15 kc., the transmitter can be modulated with a 1000 cps tone set at a level which produces 10 kc. deviation as read on the meter. At this input, the deviation limiting threshold is not exceeded and the modulation is sinusoidal. The vertical gain control on the 'scope can be used to set any convenient height, e.g., 10 squares, on the scope face for a calibration. From this point on the 'scope is an accurate deviation indicator. As a matter of fact, this was the method employed to calibrate the 'scope for this demonstration.

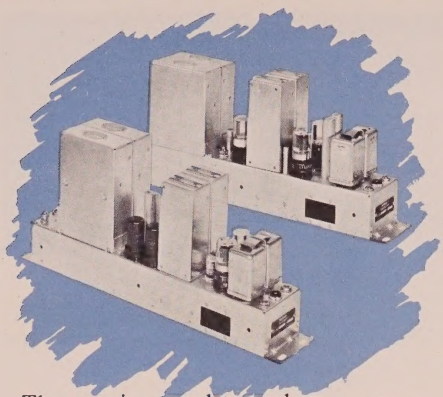
Optimum systems performance demands accurate deviation settings. Know the characteristics of your deviation measuring equipment to insure accurate settings and peak utilization of your two-way radio equipment.





(a) (b) (c)

Fig. 7 Deviation with Voice Input



VF CARRIER

this versatile communications tool enables many different signals to be transmitted simultaneously over one voice-frequency channel.

The growing trend toward automation and centralized control of remote installations increases the need for efficient utilization of communication facilities. Motorola VF (voice frequency) carrier equipment provides a communication channel for telegraphic and sub-audio (0-35 cps.) sine wave signals over an extremely small portion of the voice frequency spectrum.

A single VF carrier channel can convey signals from a remote telemetering instrument to an indicator or recorder at a control point. Similarly, it can transmit telegraph, teleprinter, or supervisory control (impulse-type) signals, as well as the "raise-neutral-lower" signals of load control devices. VF carrier can also be used for remote control, signaling, or indication.

SPECTRUM UTILIZATION

Up to 18 of these VF carrier channels can be transmitted simultaneously over one voice frequency (500-3100 cps.) channel. This voice frequency channel can be via any combination of communication media—wire line, power line carrier, VHF or UHF radio, and microwave. The non-critical upper portion of the voice frequency spectrum (2400-3100 cps.) can be utilized to transmit up to 5 VF carrier channels simultaneously with voice signals —without mutual interaction.

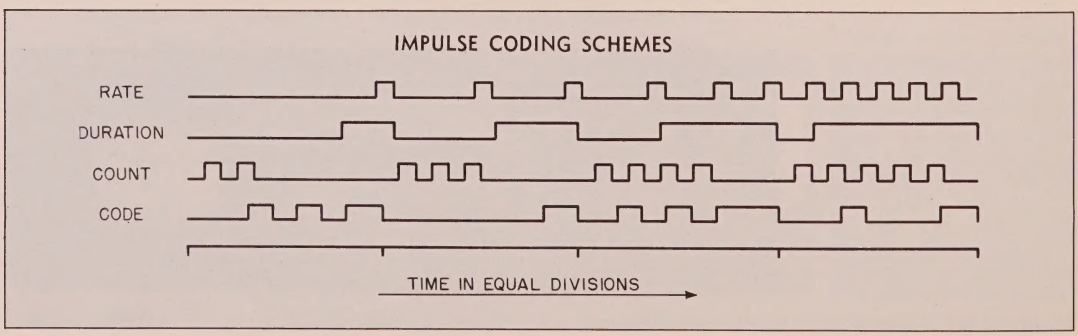
EQUIPMENT

The basic elements of Motorola VF carrier equipment are a 2-channel transmitter chassis, a 2-channel receiver chassis, and a power supply chassis which accommodates up to 10 transmitter or receiver chassis. Each channel occupies a bandwidth of 60 cps., and carrier frequencies are spaced 150 cps. apart from 525 cps. to 3075 cps.

Plug-in units provide a choice of transmitter input circuit for dry contact input, keyed-current input, or sine wave input. Two plug-in units provide a choice of dry contact or sine wave receiver output. The frequency determining elements of both chassis (RF filters, discriminator, and transmitter oscillator) are also packaged as plug-in units, enabling channel frequencies to be easily changed in the field. A "receiver-blocking" circuit is available for applications requiring an exceptional degree of security (protection against false operation). This circuit "blocks" receiver operation if the signal-to-noise ratio at the receiver frequency falls below a predetermined level. Audio frequency filters are available for any systems requirement.

SINE WAVE SIGNALS

Some types of telemetering and control devices use the frequency of a sine wave signal to transfer information. The transmitting device has a sine wave output which varies in frequency according to the information transmitted. This sine wave signal is



used to frequency-modulate the VF carrier. Motorola VF carrier equipment can transmit sine wave frequencies up to 35 cps.

PULSE SIGNALS

Pulse signals can be in the form of open and closed "dry" contacts, as well as on-off or reversed current keying. The VF carrier transmitter translates either type of input into a 60 cycle frequency-shift (from 30 cycles below center frequency to 30 cycles above center frequency). Pulse signals can be used to transmit simple "on-off" information, or more complex information such as teleprinting and telemetering signals. Motorola VF carrier equipment can transmit pulse rates up to 25 pps. Complex information is generally transmitted in one of the following constant amplitude pulse forms.

impulse duration

information is proportional to the pulse length in a system with pulses at a constant repetition rate

impulse rate

information is proportional to the pulse repetition rate in a system with pulses of constant pulse length

impulse count

information is indicated by the total number of pulses per reporting time interval in a system with pulses of constant pulse length at a varying repetition rate

impulse code

information is transmitted by constant length code groups consisting of specific configurations of varying length pulses with spaces of varying length between pulses

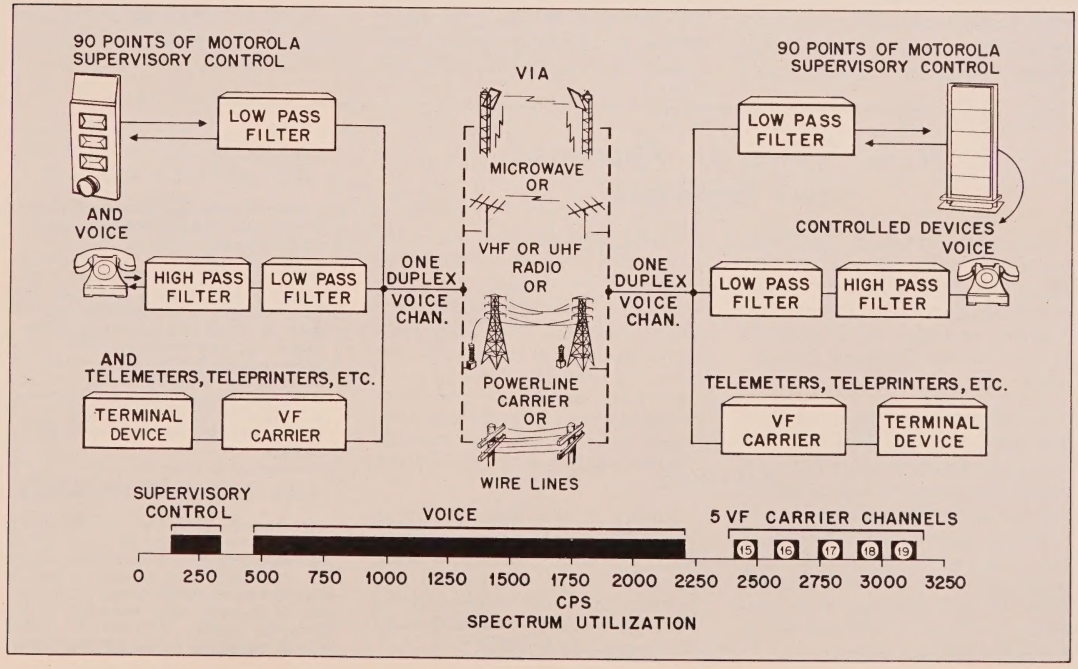
LOAD CONTROL

Some types of devices have an SPDT center-neutral output which transfers three types of information—such as the "raise-neutral-lower" signals of a load control device. Motorola VF carrier equipment translates each contact position into a specific, stable carrier frequency—30 cycles below center frequency, center frequency, or 30 cycles above center frequency. At the receiving terminal, the transmitter input information is duplicated by an SPDT center-neutral relay in the VF carrier receiver output.

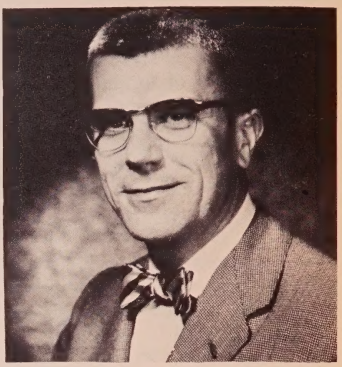
DIALING AND SIGNALING

Conventional telephone circuits generally require DC circuit continuity for transmission of dialing impulses and some signaling functions. VF carrier can be used to transmit these functions when DC circuit continuity does not exist. It can be multiplexed on the same audio channel with the voice signal to provide remote switching for dialing and signaling.

Technical Bulletin E-112, available from the Technical Information Center, provides a detailed description of Motorola VF carrier equipment.



ROY OLSON NAMED ENGINEERING DIRECTOR



Roy H. Olson

Roy H. Olson has been appointed Director of Engineering in the Communications & Electronics Division of Motorola, Inc. In this capacity he will direct the technical activity of the division's industrial products department.

Daniel E. Noble, Division vice president, announced the promotion which places Olson in charge of engineering co-ordination for industrial products and non-military research and development efforts.

Olson, 43, an electrical engineer whose 20 years in radio span projects ranging from amateur receivers to guided missile fuses, has been associated with Motorola since 1951, when he joined the company's Phoenix Research Laboratory as an engineering section leader.

A native of Mitchell County, Iowa, Olson received his electrical engineering degree from Iowa State College in 1934 and immediately began a 13-year association with Collins Radio Company. Later he operated his own manufacturing and consulting firm before coming to Motorola.

"We are extremely fortunate to have an engineer of Roy Olson's caliber guiding the Division's product research and development program," Noble stated in announcing the appointment. "His wide experience will prove very valuable as our areas of electronic product activity continue to expand."

Among his accomplishments Olson counts the design and manufacture of mobile/portable communication and broadcast transmitters, test instruments, fixed station broadcast transmitters, amateur receivers and commercial point-to-point high frequency transmitters.

In addition he has built commercial and military medium-frequency airborne transmitters, low and high-frequency radio range equipment, VHF and microwave ground and airborne transmitters and transponders, direction finders, airborne radio compass receivers and VHF omni-range equipment for both air and ground uses.

Since joining Motorola, Olson has been co-ordinator of National Bureau of Standards missile fuse projects and project leader for special military development tasks.

More recently his work has been with subminiature missile electronic fuses.

W. C. Byrne, Jr. Appointed Sales Supervisor

Walter C. Byrne, Jr. has been appointed sales supervisor for Motorola power utility products, it was announced by Leonard G. Walker, manager of Motorola's Power Utility Products Department.

Byrne will have charge of sales and application of Motorola microwave, power line carrier and supervisory control equipment to electric utility companies. In addition to supervising activities of the company's industrial communications engineers nationwide, Byrne will continue personal coverage of sales activity in the midwestern states.

Byrne has been with Motorola since 1950, first as a senior engineer and for the past two years as a specialist in industrial-utility communications. He holds both electrical and mechanical engineering degrees from Tulane University, and for several years before joining Motorola was a research engineer in the Nuclear Physics Laboratory at Tulane University.

During World War II Byrne was a Naval officer assigned to destroyer duty. An active radio amateur, Byrne constructed and demonstrated the first amateur television camera, transmitter and receiver in the South.

CHANGES IN SCHEDULE OF SERVICE CLINICS

Several changes have been made in the schedule of one-day service clinics announced in the November-December issue of the Motorola NEWSGRAM. The Columbia, S. C. meeting will be held on April 18. The Raleigh, N. C. meeting will be held on April 20. Clinics at Richmond, Va. and Baltimore, Md. have been combined into one meeting to be held in Washington, D. C. on April 22. These clinics will be open to Motorola Service Station personnel and to user-employed technicians.

$100 REWARD OFFERED

McDowell Tire Co., Kansas City, Mo., reports that one of their mobile two-way radio units was recently stolen. Mr. McDowell has offered a $100.00 reward leading to the arrest of the person or persons who stole the unit—Motorola model T44-A-6A, Serial #1938, operating in the 460 mc. band.

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	P-9087 Power Supply	71.50	
	K-9321 Alignment Tools	3.10	
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	K-9323 Alignment Tools	1.25	
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	TK165 Back Pack Kit	54.00	
	TA142 Vibrator Converter	69.50	
	TK225 Converter Adapter	6.75	
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	K-8676 Clock Movement	21.77	
	P-8257 Speaker	30.25*	
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	TOTAL THIS COLUMN		

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	6AK5	2.19	
	6AL5	.98	
	6AQ5	.94	
	6BH6	1.20	
	6BJ6	1.01	
	6SN7	1.12	
	7C5	1.12	
	7C7	1.12	
	12AT7	1.35	
	12AU7	1.14	
	12AX7	1.20	
	2E24	4.40	
	2E26	3.66	
	5R4GY	1.76	
	CK1024	3.25	
	TOTAL THIS COLUMN		
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P-8257	$28.08
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The DISCRIMINATOR

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APRIL 1955

Vol. 2 - No. 1

IDENTIFY YOURSELF

By JOHN TANSEY
National Service Manager

Motorola Service Stations can make great progress now by more closely identifying themselves with the Motorola National Service Organization.

One way you can do this is by utilizing the national service insignia which is available in the following forms:

1) As a cut for imprinting invoices,
2) In color on preprinted paper stock,
3) As an attractive outdoor baked-enamel sign,
4) As cloth patches for service attire,
5) As decals for shop windows and vehicles.

To obtain any of these service aids, contact your regional manager, your regional service manager or the national service office.

Other service aids for Motorola's Service Stations are being developed.

Real effective use of these service aids has been made by the aggressive and farsighted owners and operators of Authorized Motorola Service Stations.

One advantage of identifying yourself with Motorola is that the reputation of our company and products is associated with those who display the Motorola National Service insignia.

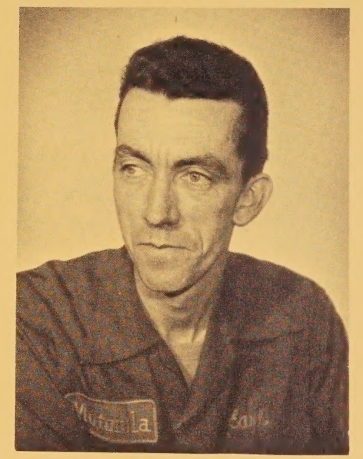
Lest it be said that credit is not given to our Service Stations often enough or in print for the contribution they have made in the past, are making now, and will make in the future to Motorola's success in the radio communications industry, let it become a matter of record that such MSS cooperation is gratefully acknowledged and deeply appreciated.

As a concluding thought, bear in mind the adage "a person is known by the company he keeps." When you keep company with Motorola, you will be well known and highly respected. In addition, you will have a "national" standing.

ELECTRONIC SERVICES—A 100% MOTOROLA SERVICE STATION

The first Motorola Service Station to convert entirely to Motorola subcontracts is Electronic Services, Milltown, Wis. It is owned and operated by Earl Clausen, who services about 100 two-way radio units within a radius of 80 miles of Milltown.

Electronic Services was started in May, 1951, has been a 100% Motorola Service Station since April, 1954. Consequently, Earl is able to compare the two types of operation—handling contracts directly and having only subcontracts. He is all in favor of the latter. He likes the fact that Motorola subcontracts help assure him of a more uniform income, without the "feast or famine" condition that can otherwise exist. He likes the Motorola back up service that enables him to maintain good customer relationships in times of sickness or other emergencies. He no longer has to worry about credit standings. And he generally has fewer worries because he knows that he has the backing of the complete facilities of Motorola.



Earl Clausen

When Earl gave his customers notice last year that in the future he would only maintain equipment under Motorola Maintenance Agreements, he received contracts for 43 units. He now has under contract 20 systems of about 100 units. These include the Wisconsin Hydro Electric Company, 6 veterinarians, 4 county sheriffs, the city police and fire departments, one county traffic system with radar speed control, a construction company, a sand and gravel company, and a taxi business.

He averages about $700 to $1,000 in billings per month. Equipment serviced ranges in vintage from 1945 to 1955, in size from 10 to 250 watts.

Earl never hesitates to give his customers the best in servicing regardless of cost. He has about $6500 invested in equipment and intends to buy more. Test equipment in his Ford Ranch Wagon includes a P-8501A, a special cable test set-up to accommodate any piece of equipment he services, an FM frequency monitor with vibrator power supply, and a stock of spare parts. In addition he often carries a model 80 signal

(Continued on page 4)

HOW TO SET UP SERVICING RATES

by JOHN P. FOGARTY, Region 9 Service Manager

For the most part the thoughts contained herein are directed toward the smaller service station operation, in particular those owned and operated by one individual.

One of the most important and usually the most unappreciated function in the operation of a successful business is that of keeping records — just plain paper work!

Many of us going into a business for the first time realize that records must be kept on those items which generally come under the heading of fixed overhead, such as rent, heat, light, phone, insurance, transportation, etc. This is true because, for the most part, the records on these items are kept for us. We are billed by the suppliers of these services periodically and by merely filing these invoices we have assembled records. Little time or effort has been devoted to accomplish this. However, it is easy for us to overlook one of the most important records, certainly that which requires the maximum of self-discipline to keep, *our record of time.* This item, which is so easy to spend and impossible to recover, is the one item over which we have the most control.

The non-revenue producing hours can be generally classified into two categories. The first, devoted to administration, would include: Planning, procurement, invoicing, collections, sales promotion, bookkeeping, and similar activities.

The time spent performing these functions is extremely important to the one-man operator since he is the purchasing agent, business manager, production manager and bookkeeper, and must therefore work these costs into his basic hourly rate structure. If these provisions are not made it will be increasingly difficult for him to expand to the point where he will someday be able to hire additional help to perform these functions.

The second category would comprise those hours lost through unforeseen contingencies brought about by factors largely beyond his direct control and also those lost due to inefficiencies within the organization itself.

A service business is similar in operation to a job shop. You have no standard product or fixed production rate which can be studied and improved over the years. For the most part each job is different to some degree and a higher percentage of lost motion is involved as compared to the pace of a production line.

You must, therefore, determine how much of your effort is lost motion. Having determined this and after a concerted effort has been made to reduce this to a minimum, your hourly rate must be sufficient to include or to pay for this unavoidable lost time. Lost time in fact then becomes a form of overhead. How, you ask, do you keep records that will give the desired information?

One method that does work—described here—was the system used in the small business for which I was responsible at one time.

Each and every employee of the corporation, including the officers, was given a pad of job sheets. It was a standard form about 3-½ x 6″ in size — just small enough to fit in a coat pocket. Each employee kept a running log of his day's activity. Since many of us worked on several different jobs each day a separate log sheet was kept in the pad for each customer. Every hour or reasonable fraction thereof was accounted for and charged against a particular job or office function. If, for example, one half hour was spent on the phone trying to locate some piece of material for a specific job, a note to this effect went on that appropriate sheet. We might then have spent 1-½ hours trying to locate some defect in one of the finished units and a note giving this information was made on the proper sheet.

Usually at the end of each week the job sheets from each person were studied. Naturally all those pertaining to one specific job were grouped together and analyzed.

About the Author . . .

John P. Fogarty was a Motorola Radio Communication Engineer for four years prior to becoming service manager of Region 9 in 1953. Before that he and two colleagues formed Aeronics Inc., a company devoted to the design and manufacture of specialized electronic control equipment. This activity was sandwiched around an 18-month hitch in the field artillery. During the early phases of World War II, he was assistant to the Chief Engineer for two radio research laboratories. The first was concerned chiefly with the design of airborne direction finders. The second was devoted to development and manufacture of miniature radio transmitting and receiving equipment which was supplied to our agents and resistance groups behind enemy lines.

John majored in electrical engineering at Stevens Institute of Technology, Hoboken, N. J., and then, being an active Ham with a deep interest in radio communications, he attended the R. C. A. Institute in New York City for two years. He was born in Hartford, Conn. in 1919.

From these records we were able to determine exactly how much time and material were spent to complete each project. More important, these records indicated how many non-productive hours were spent that week and into which of the two general categories they fell. As the number of these records increased we were able to establish average figures, which told us what percentage of our available man hours were spent on the non-productive functions of our business.

The most difficult part of this log sheet system was convincing all personnel involved of its need and how it would affect their future. However, once it became habit with all parties concerned this system produced accurate records with no apparent effort.

It is realized that most service stations keep a time and material sheet for each service call, i.e. the time required to drive to the customer, mileage involved, time spent to repair or to install the

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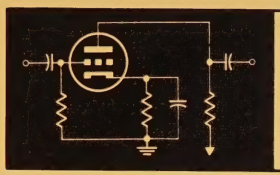
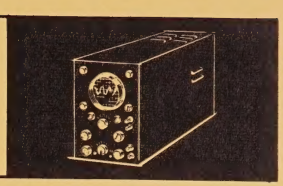


SERVICE NOTES



REDUCING SERVICING TIME

With flat rates for servicing becoming more and more common, it is essential that service stations cut servicing time whenever possible. One way of saving time and labor is to build specialized test equipment such as the following:

We developed a DC power supply that is more dependable, longer lasting and more versatile than a standard battery supply. It uses three double-pole, double-throw switches to permit connecting four automobile batteries in parallel, series-parallel or series. Thus, 6, 12 or 24 volts DC is available at the throw of a switch.

The batteries are kept in a box sealed by a lid having a rubber gasket. During charging periods gases are exhausted from the building by a small blower at one end of the box.

Also attached to the box are an ammeter and an Assembly Products regulator. The latter is a meter type switch that throws a 30-amp charger mounted on a shalf underneath the battery box from high charge to trickle when battery voltage reaches the desired value. By keeping battery voltages up to par in this manner, you make batteries last much longer than if they are allowed to pass through a number of discharge-charge cycles.

Having the four batteries in parallel for 6-volt operation provides a large current capacity when needed. The 24-volt supply is used only in special cases, as for two-way radio units for aircraft.

A savings of only 5 hours servicing time a year will pay for the extra switch and battery.

Another example of specialized test equipment that we use is a master test panel which supplies test voltages, squelch and volume controls, etc., for any piece of two-way equipment.

CECIL A. WHITE, JR.
Communications Service, Inc.
Dallas, Texas

SERVICE MEETINGS

Columbia, S. C.	Apr. 18
Raleigh, N. C.	Apr. 20
Washington, D. C.	Apr. 22
Philadelphia	May 9
Pittsburgh	May 11
Elmira, N. Y.	May 13
New York City	May 16
Hartford, Conn.	June 20
Boston, Mass.	June 22
Augusta, Maine	June 24

SIG. GENERATOR CALIBRATION

The Motorola frequency and deviation monitor can be used to calibrate any standard signal generator that is being used to realign a receiver on a specified frequency. First, connect a piece of RG58U co-ax from the generator to the monitor. Then set up the monitor on the desired frequency and adjust the signal generator to that frequency. Almost all signal generators have sufficient output to operate the monitor when coupled directly.

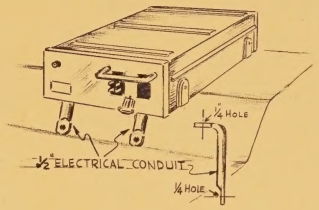
This method of calibration is particularly useful when there is no station carrier available to set the generator and receiver on the desired frequency.

DON BRICKEY
Brickey Communications Service
Decatur, Illinois

TRUNK MOUNTING

Ordinary electrician's ½" or ¾" thin wall conduit can be used to mount mobile housings on the shelf or raised portions in auto trunks. Conduit is an economical substitute for expensive, hard-to-work strap iron braces.

Nearly every electrical contractor has many short, unusable lengths of conduit in his junk pile that are available for the asking. Form the conduit to the necessary shape by pounding with a hammer or flattening in a vise. Then



bolt the upper end of the conduit to the radio housing with ¼" stove bolts. The lower end of the brace can be fastened with metal screws to the slanted portion of the "shelf" or directly to the floor of the trunk. We prefer the slanted mounting.

A word of caution! Be sure to center the seam of the tubing so that it is on the lower side and do not flatten it too much or you will greatly reduce its strength.

This method provides a rigid mounting when properly done.

ROBERT J. STIPP
Radio Communications Service
Hobbs, New Mexico

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To save time and money and keep customers better satisfied, be sure you use genuine Motorola factory parts.

Remember, too, that Motorola's new low prices on both standard and special purpose tubes mean MORE PROFITS for you.

Order parts from any of the following locations:

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Dallas 7, Texas
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811 South "B" Street
San Mateo, California
Phone: DIamond 4-6386

ELECTRONIC SERVICES

(Continued from page 1)

generator. His car is equipped with a two-way radio operating on the same frequency as the Wisconsin Hydro Electric Company for whom he provides 24-hour per day emergency service.

By promoting the sale of preventive maintenance agreements, he has been able to reduce the number of emergency service calls to about two a month. Average time spent in the field is about 35 to 40 hours. Naturally he spends some time at home on books, etc.

Earl gives a great deal of credit to his wife, who, besides caring for the family of two girls and three boys, takes calls when he is out and occasionally accompanies him on night calls. Mrs. Clausen soon learned that an "evening out" is not necessarily a night with the boys. On one occasion she spent all of one Saturday night with him at the police station while he worked from 4:00 PM to 7:AM on the equipment.

He prefers having his own business as a Motorola Service Station to that of teaching, which he did for several years after graduating from Wisconsin State College in 1940 with a B.S. degree. His interest in electronics developed during World War II when he attended radio tech school in the Navy. From 1947 to 1951, he was a radar technician in Minnesota. Then, when the Korean War started, he was recalled to naval duty and served as a communications specialist with the Marine Transport Squadron in Korea.

SERVICING RATES

(Continued from page 2)

unit, material used, etc., but we also realize that many do not keep accurate records of the time spent on administration, shop and equipment construction and maintenance of test equipment, etc.

These records or log sheets of your daily activities will also point up those phases of your operation which are reducing its overall efficiency. In this competitive age in which we live and do business we often find that the rate for a given job has been established and we must either gear our operation to fit these rates or go out of business. We have found that in several instances one service station, "A", could do a given job for a certain fee while the next station, "B", felt the same charge for a similar job was insufficient to produce the desired profit margin.

A close scrutiny of the two operations usually reveals one of the following conditions: The records of Station "A" were insufficient and did not reflect all of the costs involved or, again due to inadequate records, Station "B" was unable to recognize and correct the inefficiencies within his own organization. It is not difficult to realize that if a realistic rate has been established for a given job and all other factors are equal you will be able to measure your profit in terms of your operational efficiency.

Since there is now a definite trend within the industry to perform service at a fixed fee including material and labor the need for complete records becomes more evident. It is just as important to determine the degree of profit as it is to determine whether or not there is profit at all. You must know exactly at what rate you can perform any given job. Obviously if you GUESS too low too often you will soon find the wolf at your door and if you GUESS too high too often you will find thriving competition next door.

WHY KEEP RECORDS?

by ED HARTY
Chief Accountant, MOTOROLA, INC.

The article "Budget For Profit" in the last issue of THE DISCRIMINATOR set forth the philosophy of intelligently managing a business by careful planning of all expenses and relating them to the expected dollars of income. Before a business is started, careful consideration is given to the probability of that business earning a profit. The need for the product or service is evaluated, costs are analysed, consideration is given to the competition in the field, and finally, the pricing structure is reviewed.

If such careful planning is deemed necessary before a business is started, it is also important that careful planning be employed by an established business.

Every business, if it is to be successful, must be guided by individuals with a plan of action. Budgeting is a tool whereby that plan is converted to figures, and its intelligent use will result in a most satisfying experience for all associated with the enterprise.

It must be recognized, however, that budgeting is of little value if it is not compared with actual results of operation. Sales and Expense must be accumulated in the same manner and categories as the budget was prepared. The reasons for variations must be examined and evaluated.

In order to get these results, it is necessary that certain records be kept. It is not intended that this article or any article to appear in subsequent issues of THE DISCRIMINATOR, will set forth an accounting system, because the various sizes and types of business would preclude the possibility of doing so.

It is recommended, however, that if a problem in keeping records of your operation exists, that the services of a concern specializing in maintaining the books and records of companies in your area be considered.

It is necessary that certain and complete records must be maintained if the reports required by Federal, State and Local Governments are to be prepared correctly. Consultation with a capable independent auditor will further insure that all necessary reports are being filed with the proper governmental agencies. You can also expect to be kept informed of changes in the tax law that might result in a substantial savings of cash. The Internal Revenue Act of 1954 contains many changes that might affect the tax that you pay. For example, the new Act provides for accelerated depreciation on all fixed assets acquired in 1954.

The problem should not be avoided by the notion that it is too costly to keep adequate records. It is more true that it is too costly not to keep them.

TRANSMISSIONS . . . On Communications Topics

Airplane Shuttle System

A major domestic airline is now using radio-equipped tractors to tow planes between its hanggars and the passenger terminal. The company estimates that the radio installation will enable it to reduce the gasoline bill by $42,500 a year. The new ferry system, which shuttles at least eight DC-6's a day back and forth between hangar and terminal, saves 75 gallons of aviation gasoline each trip. The tractor itself consumes less than a gallon of standard auto fuel for each round trip. Added benefit is reduced wear and tear on the plane ignition system and engines.

A Firefighter's Christmas Present

Mark Beltaire recently told an interesting story in the **Detroit Free Press** about **Chief Nicholas Barsheef** of the **Harrison Township Fire Department.** When several gallons of fuel oil were mixed with gasoline and sold by mistake, the chief, his assistant and 15 volunteers helped 30 men from the oil company in a successful house-to-house search that lasted until 2 a.m. They recovered all of the dangerous mixture without a single accident. Oil company officials wanted to repay the township men for their help and asked them what they wanted. A new TV set for the fire station? "We'd like a two-way radio to make our equipment more effective," said the chief. Needless to say, they got it.

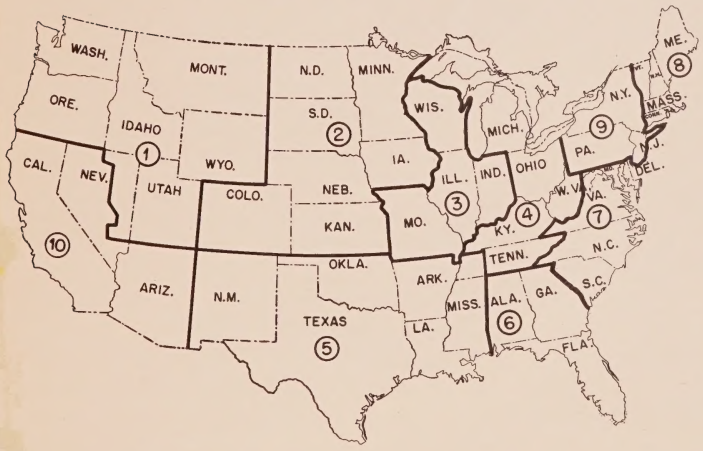
When Seconds Count

Two-way radio may soon become standard equipment at auto races where every second counts. Tests show that crews can radio warnings to drivers to help them avoid dangerous pileups that might be out of sight up the track. Too often hand signals and blackboard instructions from the pits are missed by speeding drivers. Two-way radio will also allow the driver to tell his crew before he stops what refueling and repairs his car will need.

On And On And On

How often is a base station transmitter keyed? When the **Yellow Cab Co.,** Oklahoma City, bought a Motorola unit in March, 1952, their technician, **Elmo Black,** installed a counter on it to determine the number of times it was keyed in each 24 hours. The figure varied from 9,000 to 14,000 with an average of about 11,000 times each day or about 7.6 times a minute. On November 15, 1954, 31½ months after installation, the original transmit-receive relay finally had to be replaced. During its "life" it had operated about 10,395,000 times.

REGIONAL DIRECTORY . . .



REGION 1
DONALD F. BRICKLEY, Mgr.
3833 N.E. Union Ave., Portland, Ore.
Phone: TUXEDO 5428

REGION 2
EUGENE F. BROWN, Mgr.
817 Kilpatrick Bldg., Omaha, Nebr.
Phone: WEBSTER 0017

REGION 3
HOMER L. MARRS, Mgr.
1400 N. Cicero Ave., Chicago 51, Ill.
Phone: ESTEBROOK 9-0122

REGION 4
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19142 James Couzens Hwy.,
Detroit 35, Mich.
Phone: UNIVERSITY 3-6464

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Phone: STERLING 4951

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HORACE E. BOYLAN, Mgr.
Stallings Bldg., Rm. 601, 1829 First Ave., North, Birmingham, Ala.
Phone: 4-4582

REGION 7
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Washington 14, D. C.
Phone: OLIVER 6-4900

REGION 8
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Phone: 6-2482

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FRANK W. WALKER, Mgr.
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CARRYING CASE Heavy canvas, sponge rubber padded, zipper closure, with spare battery compartment, for "Handie-Talkie" radiophone models. **K-8604 $19.95**

CARRYING CASE Heavy canvas, sponge rubber padded for "Handie-Talkie" pack. **K-9099 $39.30**

BACK PACK KIT Shoulder straps, push-to-talk microphone, Telex ear piece, volume control, for "Handie-Talkie" models. **TK165 $54.00**

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POWER SUPPLY Plug-in power supply with cables to operate a "Handie-Talkie" pack from **6 VDC** or **117 VAC** to conserve dry batteries. **P-9087 $71.50**

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Keep an extra set handy

K-9321 Two nylon all-purpose tools, transmitter and receiver.....$3.10

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VIBRATOR CONVERTER Provides 6 VDC for radio operation in 12 VDC vehicles. For 10- to 30-watt Motorola "Research" Line transmitter-receiver mobile units. Use with **TK255** Adapter for "Deluxe" Line.

TA142 Vibrator Converter.....$69.50

TK225 Adapter.....$6.75

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FOOT SWITCH Transmitter push-to-talk control.
K-8205.....$6.75

CLOCK Cyclometer type clock works for replacement or special use.
K-8676.....$21.77

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P-8257 3 ohm.....$30.25
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5R4GY	$1.76	CK1024	$3.25

PALM TYPE MICROPHONES
With coiled cords—for test and replacement use

P-255-A With mtg. clip and 4 pin connector.....$17.00
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Prices do not include applicable taxes (except F.E.T.) or shipping charges.

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